

Title: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING  
AND EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM  
COMPONENTS

Inventor: Bond, et al; Serial No.: 09/900,522; filed 7/6/01  
Atty. Ref. No.: 7784-000260; Harness Dickey & Pierce (248) 641-1600

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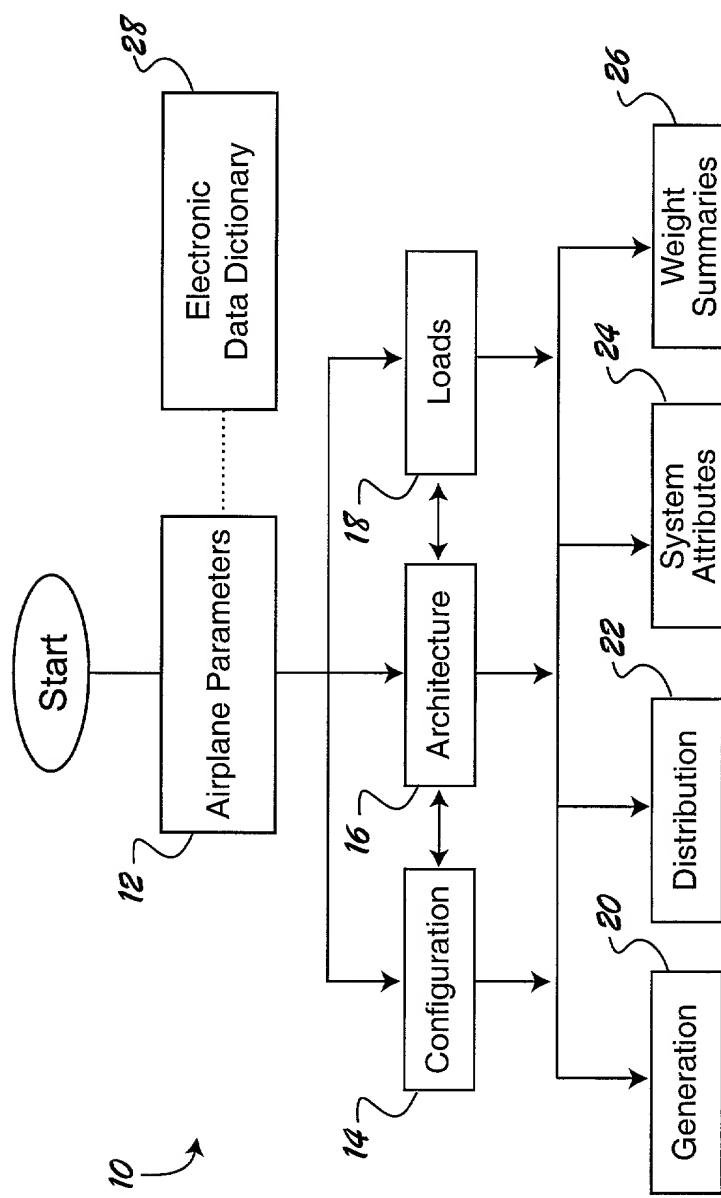


FIG. 1

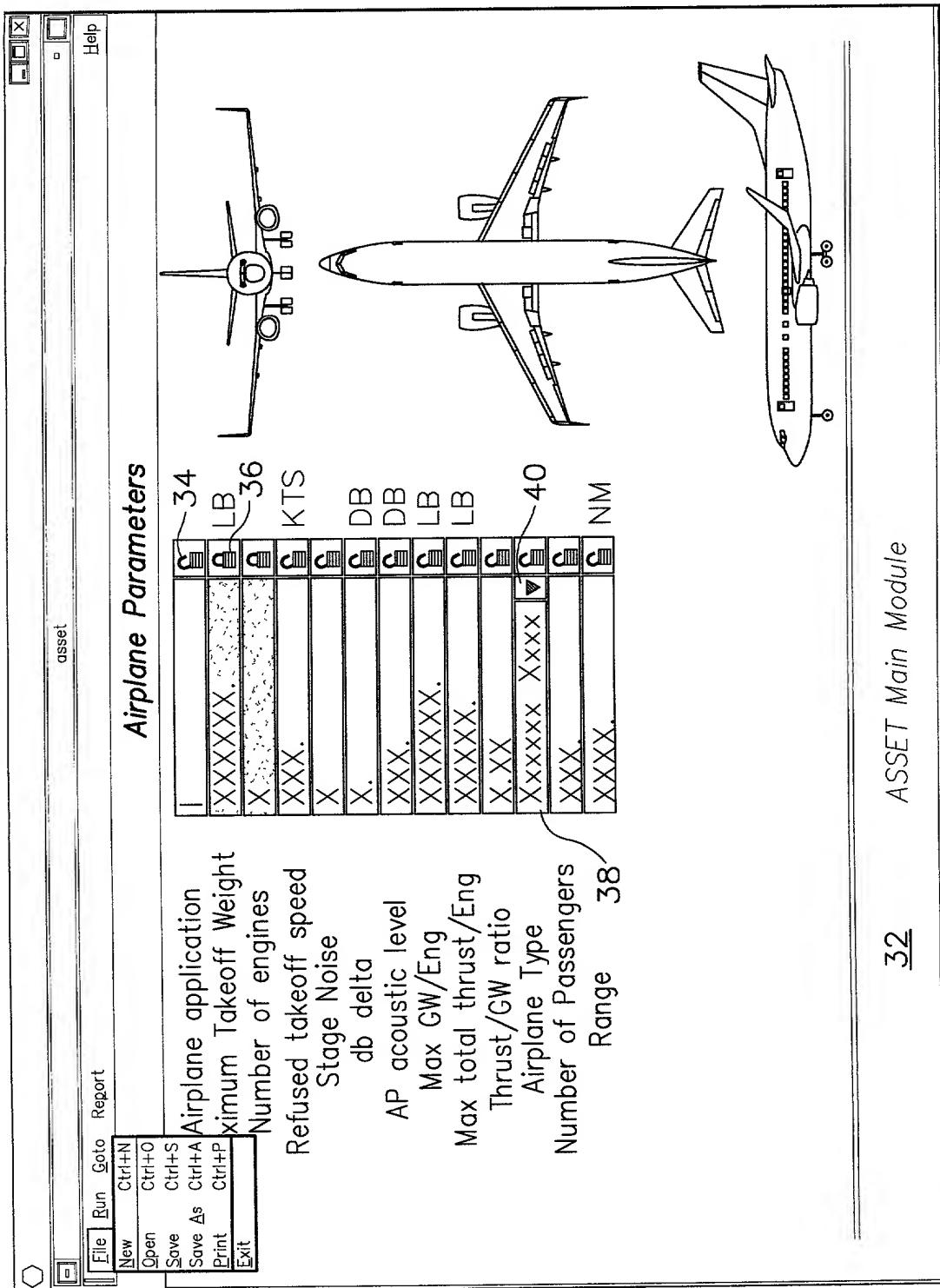


FIG. 2

asset

Help

File Run Goto Report  
Calculate **Optimize**

44 Airplane application

|                        |     |
|------------------------|-----|
| Maximum Takeoff Weight | LB  |
| Number of engines      | KTS |
| Refused takeoff speed  | DB  |
| Stage Noise            | DB  |
| db delta               | LB  |
| AP acoustic level      | LB  |
| Max GW/Eng             | LB  |
| Max total thrust/Eng   | LB  |
| Thrust/GW ratio        | LB  |
| Airplane Type          | NM  |
| Number of Passengers   | NM  |
| Range                  | NM  |

ASSET Main Module

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FIG. 3

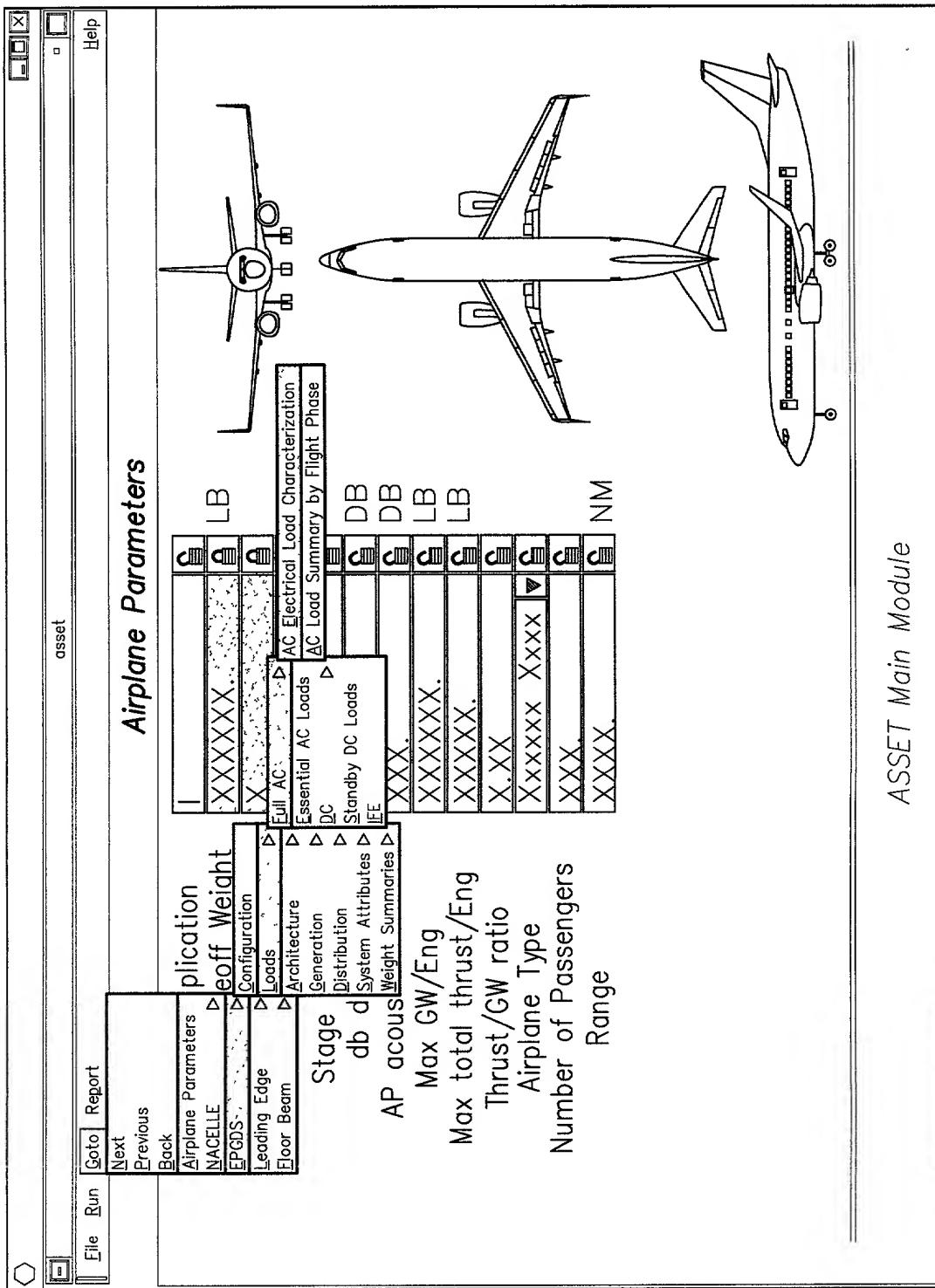


FIG. 4

ASSET EPADS Configuration

General:

48a 48 50

|                                      |                                          |
|--------------------------------------|------------------------------------------|
| Fly-by-Wire                          | <input checked="" type="checkbox"/> TRUE |
| Frequency Type                       | Xxxxxxx                                  |
| Dual EE Bay                          | <input type="checkbox"/> FALSE           |
| Double Voltage                       | <input type="checkbox"/> FALSE           |
| RAT Generator?                       | <input checked="" type="checkbox"/> TRUE |
| Technology Era                       | Xxxxxxx                                  |
| Fuselage Length                      | XXX.XXX                                  |
| Fuselage Diameter                    | XXX.XXX                                  |
| Number of Passenger Entry/Exit Doors | X                                        |
| Number of External Power Panels      | X                                        |
| Fan Diameter                         | XXX.XXX                                  |
| Sweep Angle                          | XXX.XXX                                  |
| Wing Span                            | XXX.XXX                                  |
| Horizontal Tail Span                 | XXX.XXX                                  |

ASSET EPADS Method

FIG. 5A

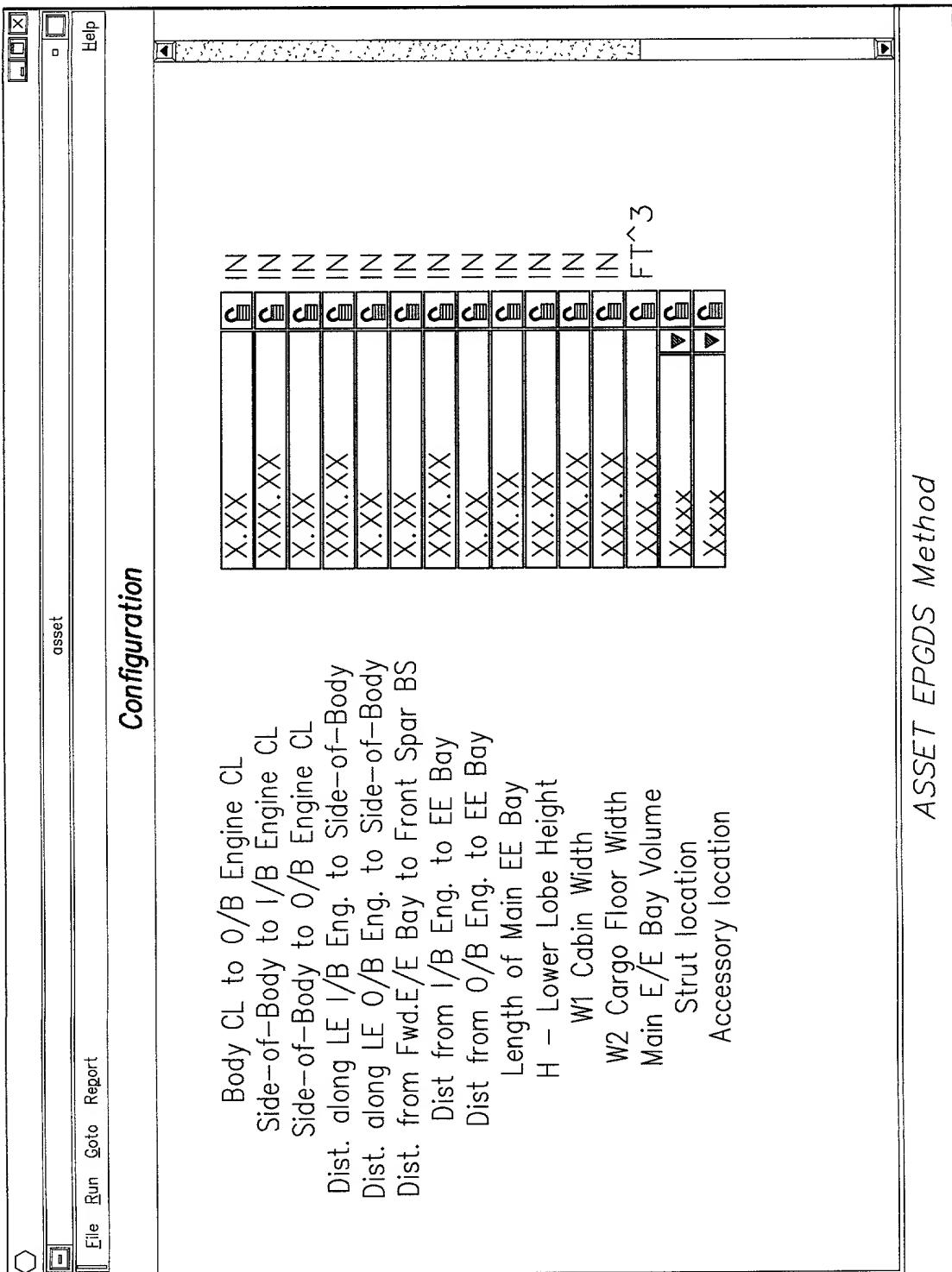


FIG. 5B

| AC Electrical Load Characterization  |                                     |
|--------------------------------------|-------------------------------------|
| Number of Fans                       | <input checked="" type="checkbox"/> |
| Recirculation Fans                   | <input checked="" type="checkbox"/> |
| Number of E/E Cooling Vent Fans      | <input checked="" type="checkbox"/> |
| Number of E/E Cooling Supply Fans    | <input checked="" type="checkbox"/> |
| Number of TRUs                       | <input checked="" type="checkbox"/> |
| Number of ACMPs                      | <input checked="" type="checkbox"/> |
| Number of Window/Windshield Heaters  | <input checked="" type="checkbox"/> |
| Number of Lavatories                 | <input checked="" type="checkbox"/> |
| 52                                   |                                     |
| Number of Wide Body Pumps            | <input checked="" type="checkbox"/> |
| Number of Wide Body Boost Pumps      | <input checked="" type="checkbox"/> |
| Number of Wide Body Override Pumps   | <input checked="" type="checkbox"/> |
| Number of Wide Body Jettison Pumps   | <input checked="" type="checkbox"/> |
| Number of Narrow Body Pumps          | <input checked="" type="checkbox"/> |
| Number of Narrow Body Boost Pumps    | <input checked="" type="checkbox"/> |
| Number of Narrow Body Override Pumps | <input checked="" type="checkbox"/> |
| Number of Narrow Body Jettison Pumps | <input checked="" type="checkbox"/> |

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**AC Load Summary by Flight Phase**

| ATA Subsystems                                             | --Passenger Loading-- | --Engine Start-- | --Taxi Out-- |            |            |            |            |            |
|------------------------------------------------------------|-----------------------|------------------|--------------|------------|------------|------------|------------|------------|
|                                                            | (kVA)                 | (PF)             | (kVA)        | (PF)       | (kVA)      | (PF)       | (kVA)      | (PF)       |
| 21 Air Conditioning                                        | ◇ X.XX   C            | ◇ X.XX   C       | ◇ X.XX   C   | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C |
| 22 Auto Flight                                             | ◇ X.XX   C            | ◇ X.XX   C       | ◇ X.XX   C   | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C |
| 23 Communications                                          | ◇ X.XX   C            | ◇ X.XX   C       | ◇ X.XX   C   | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C |
| 24 Electrical Power                                        | ◇ X.XX   C            | ◇ X.XX   C       | ◇ X.XX   C   | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C |
| 25 Equipment/Furnishings                                   | ◇ X.XX   C            | ◇ X.XX   C       | ◇ X.XX   C   | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C |
| 26 Fire Protection                                         | ◇ X.XX   C            | ◇ X.XX   C       | ◇ X.XX   C   | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C |
| 27 Flight Control                                          | ◇ X.XX   C            | ◇ X.XX   C       | ◇ X.XX   C   | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C |
| 28 Fuel                                                    | ◇ X.XX   C            | ◇ X.XX   C       | ◇ X.XX   C   | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C |
| 29 Hydraulic Power System                                  | ◇ X.XX   C            | ◇ X.XX   C       | ◇ X.XX   C   | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C |
| 30 Ice/Rain Protection                                     | ◇ X.XX   C            | ◇ X.XX   C       | ◇ X.XX   C   | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C |
| 31 Instruments                                             | ◇ X.XX   C            | ◇ X.XX   C       | ◇ X.XX   C   | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C |
| 32 Landing Gear                                            | ◇ X.XX   C            | ◇ X.XX   C       | ◇ X.XX   C   | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C | ◇ X.XX   C |
|                                                            |                       |                  |              |            |            |            |            |            |
| Maximum Flight Phase Load <→ XXX.XX   C kVA <→ X.XX   C PF |                       |                  |              |            |            |            |            |            |

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ASSET EPGDS Method

FIG. 7A

| ATA Subsystems              | AC Load Summary by Flight Phase |                  |               |
|-----------------------------|---------------------------------|------------------|---------------|
|                             | --Passenger Loading--           | --Engine Start-- | --Taxi Out--- |
|                             | (kVA)                           | (kVA)            | (kVA)         |
| 32 Landing Gear             | ◇ X. XX                         | ◇ X. XX          | ◇ X. XX       |
| 33 Lights                   | ◇ XXX. XX                       | ◇ X. XX          | ◇ X. XX       |
| 34 Navigation               | ◇ X. XX                         | ◇ X. XX          | ◇ X. XX       |
| 35 Oxygen                   | ◇ X. XX                         | ◇ X. XX          | ◇ X. XX       |
| 36 Pneumatics               | ◇ X. XX                         | ◇ X. XX          | ◇ X. XX       |
| 38 Water /Waste             | ◇ X. XX                         | ◇ X. XX          | ◇ X. XX       |
| 46 Electronic Library       | ◇ X. XX                         | ◇ X. XX          | ◇ X. XX       |
| 48 Airplane Auxiliary Power | ◇ X. XX                         | ◇ X. XX          | ◇ X. XX       |
| 52 Doors                    | ◇ X. XX                         | ◇ X. XX          | ◇ X. XX       |
| 57 Folding Wing             | ◇ X. XX                         | ◇ X. XX          | ◇ X. XX       |
| 73 Engine Fuel Control      | ◇ X. XX                         | ◇ X. XX          | ◇ X. XX       |
| 74 Ignition                 | ◇ X. XX                         | ◇ X. XX          | ◇ X. XX       |
| Maximum Flight Phase Load   |                                 |                  |               |
|                             | ◇ XXX. XX                       | ◇ KVA            | ◇ X. XX       |
|                             |                                 |                  | PF            |

FIG. 7B

ASSET

File Run Goto Report Help

**AC Load Summary by Flight Phase**

---Take-off & Climb---    ---Cruise---    ---Descent & Land---

| ATA Subsystems                                               | (kVA)      | (PF)       | (kVA)      | (PF)       | (kVA)      | (PF)       |
|--------------------------------------------------------------|------------|------------|------------|------------|------------|------------|
| 32 Landing Gear                                              | ◇ X.XX   C |
| 33 Lights                                                    | ◇ X.XX   C |
| 34 Navigation                                                | ◇ X.XX   C |
| 35 Oxygen                                                    | ◇ X.XX   C |
| 36 Pneumatics                                                | ◇ X.XX   C |
| 38 Water/Waste                                               | ◇ X.XX   C |
| 46 Electronic Library                                        | ◇ X.XX   C |
| 49 Airplane Auxiliary Power                                  | ◇ X.XX   C |
| 52 Doors                                                     | ◇ X.XX   C |
| 57 Folding Wing                                              | ◇ X.XX   C |
| 73 Engine Fuel Control                                       | ◇ X.XX   C |
| 74 Ignition                                                  | ◇ X.XX   C |
| Maximum Flight Phase Load → [XXX.XX   C] KVA → [X.XX   C] PF |            |            |            |            |            |            |
| ASSET ERGDS Method                                           |            |            |            |            |            |            |

FIG. 7C

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AC Load Summary by Flight Phase

| ATA Subsystems            | Take-off & Climb |        |         | Cruise |         |        | Descent & Land |        |  |
|---------------------------|------------------|--------|---------|--------|---------|--------|----------------|--------|--|
|                           | (kVA)            | (PF)   | (kVA)   | (PF)   | (kVA)   | (PF)   | (kVA)          | (PF)   |  |
| 73 Engine Fuel Control    | <>XX.XX          | <>X.XX | <>XX.XX | <>X.XX | <>XX.XX | <>X.XX | <>XX.XX        | <>X.XX |  |
| 74 Ignition               | <>X.XX           | <>X.XX | <>X.XX  | <>X.XX | <>X.XX  | <>X.XX | <>X.XX         | <>X.XX |  |
| 75 Air                    | <>X.XX           | <>X.XX | <>X.XX  | <>X.XX | <>X.XX  | <>X.XX | <>X.XX         | <>X.XX |  |
| 76 Engine Controls        | <>X.XX           | <>X.XX | <>X.XX  | <>X.XX | <>X.XX  | <>X.XX | <>X.XX         | <>X.XX |  |
| 77 Engine Indicating      | <>X.XX           | <>X.XX | <>X.XX  | <>X.XX | <>X.XX  | <>X.XX | <>X.XX         | <>X.XX |  |
| 78 Exhaust                | <>X.XX           | <>X.XX | <>X.XX  | <>X.XX | <>X.XX  | <>X.XX | <>X.XX         | <>X.XX |  |
| 79 Oil                    | <>X.XX           | <>X.XX | <>X.XX  | <>X.XX | <>X.XX  | <>X.XX | <>X.XX         | <>X.XX |  |
| 80 Starting               |                  |        |         |        |         |        |                |        |  |
| Flight Phase Subtotals    |                  |        |         |        |         |        |                |        |  |
| Error/Growth Factor( 15%) |                  |        |         |        |         |        |                |        |  |
| Flight Phase Totals       |                  |        |         |        |         |        |                |        |  |
| Maximum Flight Phase Load | <>XXX.XX         | <>X.XX | <>KVA   | <>X.XX | <>PF    |        |                |        |  |

ASSET EPGDS Method

FIG. 7D

**Essential AC Loads**

|                                           | Quantity | Load per Unit | Totals                                              |
|-------------------------------------------|----------|---------------|-----------------------------------------------------|
| Number of Upper Recirculating Fans        | X.X      | @<> X.XX KVA  | Total Fan Load XXX.XX KVA                           |
| Number of Lower Recirculating Fans        | X.X      | @<> X.XX KVA  |                                                     |
| Number of E/E Cooling Supply Fans         | X.X      | @<> X.XX KVA  |                                                     |
| Number of E/E Cooling Vent Fans           | X.X      | @<> X.XX KVA  |                                                     |
| Number of Hydraulic ACMP Pumps            | X.X      | @<> X.XX KVA  | Total Pump Load XXX.XX KVA                          |
| Number of Fuel Boost Pumps                | X.X      | @<> X.XX KVA  |                                                     |
| Number of Fuel Override Pumps             | X.X      | @<> X.XX KVA  |                                                     |
| Baseline Flight & Electronic, Ice & Rain  | X.XX     | KVA           | Passenger Load X.XX KVA                             |
| Baseline Flight & Electronic, Electronics | X.XX     | KVA           | Baseline Flight & Electronics Total Load XXX.XX KVA |
|                                           |          |               | Subtotal of Essential Loads XXX.XX KVA              |
|                                           |          |               | General Feeder Loss X.XX KVA                        |
|                                           |          |               | Total of Essential Loads XXX.XX KVA                 |

FIG. 8

58 ASSET EPGDS Method

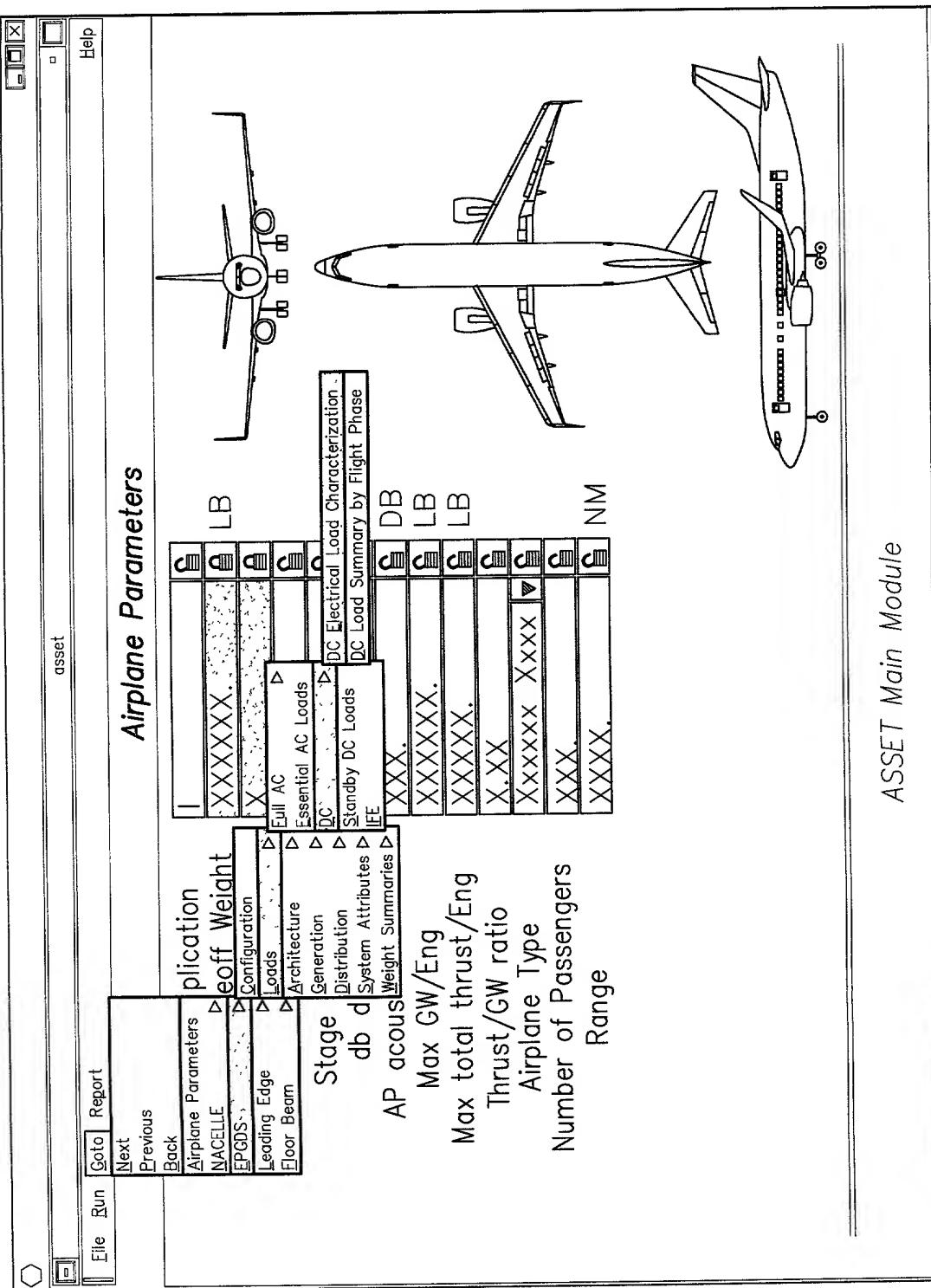


FIG. 9

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND  
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

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The screenshot shows a software window titled 'ASSET EPGDS Method'. The menu bar includes 'File', 'Run', 'Goto', 'Report', 'asset', 'Help', and standard window controls. The main content area is a table titled 'DC Electrical Load Characterization' with the following data:

|  | Number of Main Landing Gear Wheels | Number of APU Generators | Number of Doors | Number of Tanks |
|--|------------------------------------|--------------------------|-----------------|-----------------|
|  | X.X                                | X.X                      | X.X             | X.X             |
|  | X.X                                | X.X                      | X.X             | X.X             |
|  | X.X                                | X.X                      | X.X             | X.X             |
|  | X.X                                | X.X                      | X.X             | X.X             |

FIG. 10

asset

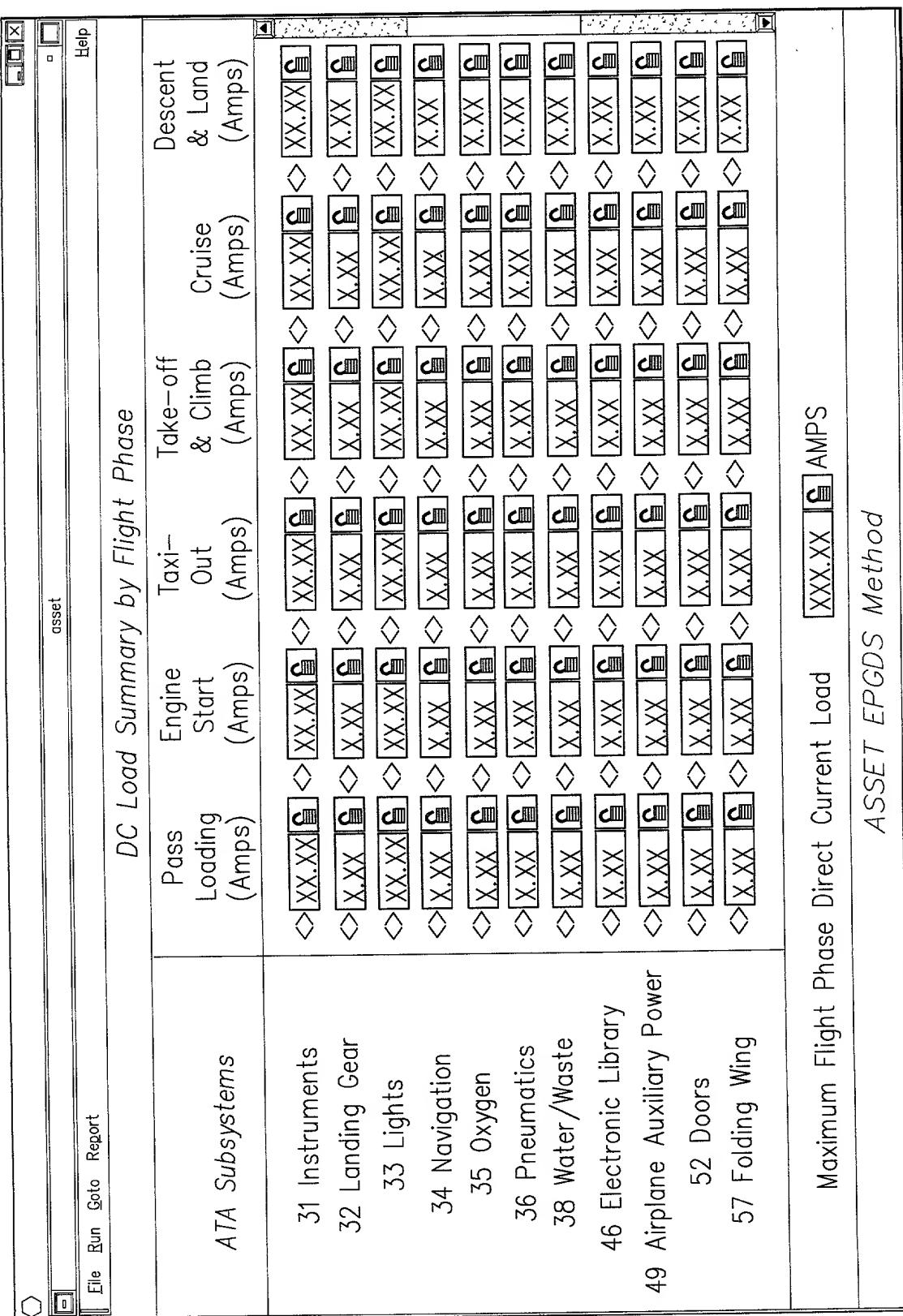
File Run Goto Report

DC Load Summary by Flight Phase

| ATA Subsystems                           | Pass Loading (Amps) | Engine Start (Amps) | Taxi- Out (Amps) | Take-off & Climb (Amps) | Cruise (Amps) | Descent & Land (Amps) |
|------------------------------------------|---------------------|---------------------|------------------|-------------------------|---------------|-----------------------|
| 21 Air Conditioning                      | ◇XX.XX G            | ◇XX.XX G            | ◇XX.XX G         | ◇XX.XX G                | ◇XX.XX G      | ◇XX.XX G              |
| 22 Auto Flight                           | ◇XX G               | ◇XX G               | ◇XX G            | ◇XX G                   | ◇XX G         | ◇XX G                 |
| 23 Communications (IFE, AVOD)            | ◇XX G               | ◇XX G               | ◇XX G            | ◇XX G                   | ◇XX G         | ◇XX G                 |
| 24 Electrical Power                      | ◇XX G               | ◇XX G               | ◇XX G            | ◇XX G                   | ◇XX G         | ◇XX G                 |
| 25 Equipment/Furnishings                 | ◇XX.XX G            | ◇XX.XX G            | ◇XX.XX G         | ◇XX.XX G                | ◇XX.XX G      | ◇XX.XX G              |
| 26 Fire Protection                       | ◇XX G               | ◇XX G               | ◇XX G            | ◇XX G                   | ◇XX G         | ◇XX G                 |
| 27 Flight Control                        | ◇XX G               | ◇XX G               | ◇XX G            | ◇XX G                   | ◇XX G         | ◇XX G                 |
| 28 Fuel                                  | ◇XX G               | ◇XX G               | ◇XX G            | ◇XX G                   | ◇XX G         | ◇XX G                 |
| 29 Hydraulic Power System                | ◇XX.XX G            | ◇XX.XX G            | ◇XX.XX G         | ◇XX.XX G                | ◇XX.XX G      | ◇XX.XX G              |
| 30 Ice/Rain Protection                   | ◇XX G               | ◇XX G               | ◇XX G            | ◇XX G                   | ◇XX G         | ◇XX G                 |
| 31 Instruments                           | ◇XX.XX G            | ◇XX.XX G            | ◇XX.XX G         | ◇XX.XX G                | ◇XX.XX G      | ◇XX.XX G              |
| Maximum Flight Phase Direct Current Load |                     |                     |                  |                         |               |                       |
| ASSET EPGDS Method                       |                     |                     |                  |                         |               |                       |

FIG. 11A

20050701 \* 2200000000000000



The screenshot shows a software window titled "DC Load Summary by Flight Phase". The window has a menu bar with "File", "Run", "Goto", "Report", "asset", and "Help". The main area is a table with the following columns:

- ATA Subsystems
- Pass Loading (Amps)
- Engine Start (Amps)
- Taxi- Out (Amps)
- Take-off & Climb (Amps)
- Cruise (Amps)
- Descent & Land (Amps)

The table lists the following subsystems and their corresponding load values:

| ATA Subsystems                                           | Pass Loading (Amps)                                                   | Engine Start (Amps) | Taxi- Out (Amps) | Take-off & Climb (Amps) | Cruise (Amps) | Descent & Land (Amps) |
|----------------------------------------------------------|-----------------------------------------------------------------------|---------------------|------------------|-------------------------|---------------|-----------------------|
| 31 Instruments                                           | <>XX.XX A |                     |                  |                         |               |                       |
| 32 Landing Gear                                          | <>XX.XX A <>X.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>X.XX A <>XX.XX A   |                     |                  |                         |               |                       |
| 33 Lights                                                | <>XX.XX A |                     |                  |                         |               |                       |
| 34 Navigation                                            | <>XX.XX A <>X.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A  |                     |                  |                         |               |                       |
| 35 Oxygen                                                | <>XX.XX A <>X.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A  |                     |                  |                         |               |                       |
| 36 Pneumatics                                            | <>XX.XX A <>X.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A  |                     |                  |                         |               |                       |
| 38 Water/Waste                                           | <>XX.XX A <>X.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A  |                     |                  |                         |               |                       |
| 46 Electronic Library                                    | <>XX.XX A <>X.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A  |                     |                  |                         |               |                       |
| 49 Airplane Auxiliary Power                              | <>XX.XX A <>X.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A  |                     |                  |                         |               |                       |
| 52 Doors                                                 | <>XX.XX A <>X.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A  |                     |                  |                         |               |                       |
| 57 Folding Wing                                          | <>XX.XX A <>X.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A <>XX.XX A  |                     |                  |                         |               |                       |
| Maximum Flight Phase Direct Current Load XXX.XX  A  AMPS |                                                                       |                     |                  |                         |               |                       |
| ASSET EPGDS Method                                       |                                                                       |                     |                  |                         |               |                       |

FIG. 11B

ASSET

asset

File Run Goto Report Help

**DC Load Summary by Flight Phase**

| ATA Subsystems                           | Pass Loading (Amps) | Engine Start (Amps) | Taxi- Out (Amps) | & Climb (Amps) | Take-off (Amps) | Cruise (Amps) | Descent & Land (Amps) |           |
|------------------------------------------|---------------------|---------------------|------------------|----------------|-----------------|---------------|-----------------------|-----------|
|                                          |                     |                     |                  |                |                 |               | XX.XX                 | XX.XX     |
| 52 Doors                                 | <>XX.XX             | <>XX.XX             | <>XX.XX          | <>XX.XX        | <>XX.XX         | <>XX.XX       | <>XX.XX               | <>XX.XX   |
| 57 Folding Wing                          | <>XX.XX             | <>XX.XX             | <>XX.XX          | <>XX.XX        | <>XX.XX         | <>XX.XX       | <>XX.XX               | <>XX.XX   |
| 73 Engine Fuel Control                   | <>XX.XX             | <>XX.XX             | <>XX.XX          | <>XX.XX        | <>XX.XX         | <>XX.XX       | <>XX.XX               | <>XX.XX   |
| 74 Ignition                              | <>XX.XX             | <>XX.XX             | <>XX.XX          | <>XX.XX        | <>XX.XX         | <>XX.XX       | <>XX.XX               | <>XX.XX   |
| 75 Air                                   | <>XX.XX             | <>XX.XX             | <>XX.XX          | <>XX.XX        | <>XX.XX         | <>XX.XX       | <>XX.XX               | <>XX.XX   |
| 76 Engine Controls                       | <>XX.XX             | <>XX.XX             | <>XX.XX          | <>XX.XX        | <>XX.XX         | <>XX.XX       | <>XX.XX               | <>XX.XX   |
| 77 Engine Indicating                     | <>XX.XX             | <>XX.XX             | <>XX.XX          | <>XX.XX        | <>XX.XX         | <>XX.XX       | <>XX.XX               | <>XX.XX   |
| 78 Exhaust                               | <>XX.XX             | <>XX.XX             | <>XX.XX          | <>XX.XX        | <>XX.XX         | <>XX.XX       | <>XX.XX               | <>XX.XX   |
| 79 Oil                                   | <>XX.XX             | <>XX.XX             | <>XX.XX          | <>XX.XX        | <>XX.XX         | <>XX.XX       | <>XX.XX               | <>XX.XX   |
| 80 Starting                              | <>XX.XX             | <>XX.XX             | <>XX.XX          | <>XX.XX        | <>XX.XX         | <>XX.XX       | <>XX.XX               | <>XX.XX   |
| Flight Phase Totals                      | <>XXXX.XX           | <>XXXX.XX           | <>XXXX.XX        | <>XXXX.XX      | <>XXXX.XX       | <>XXXX.XX     | <>XXXX.XX             | <>XXXX.XX |
| Maximum Flight Phase Direct Current Load | XXXX.XX             |                     | AMPS             |                |                 |               |                       |           |
| ASSET EPGDS Method                       |                     |                     |                  |                |                 |               |                       |           |

FIG. 11C

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND  
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

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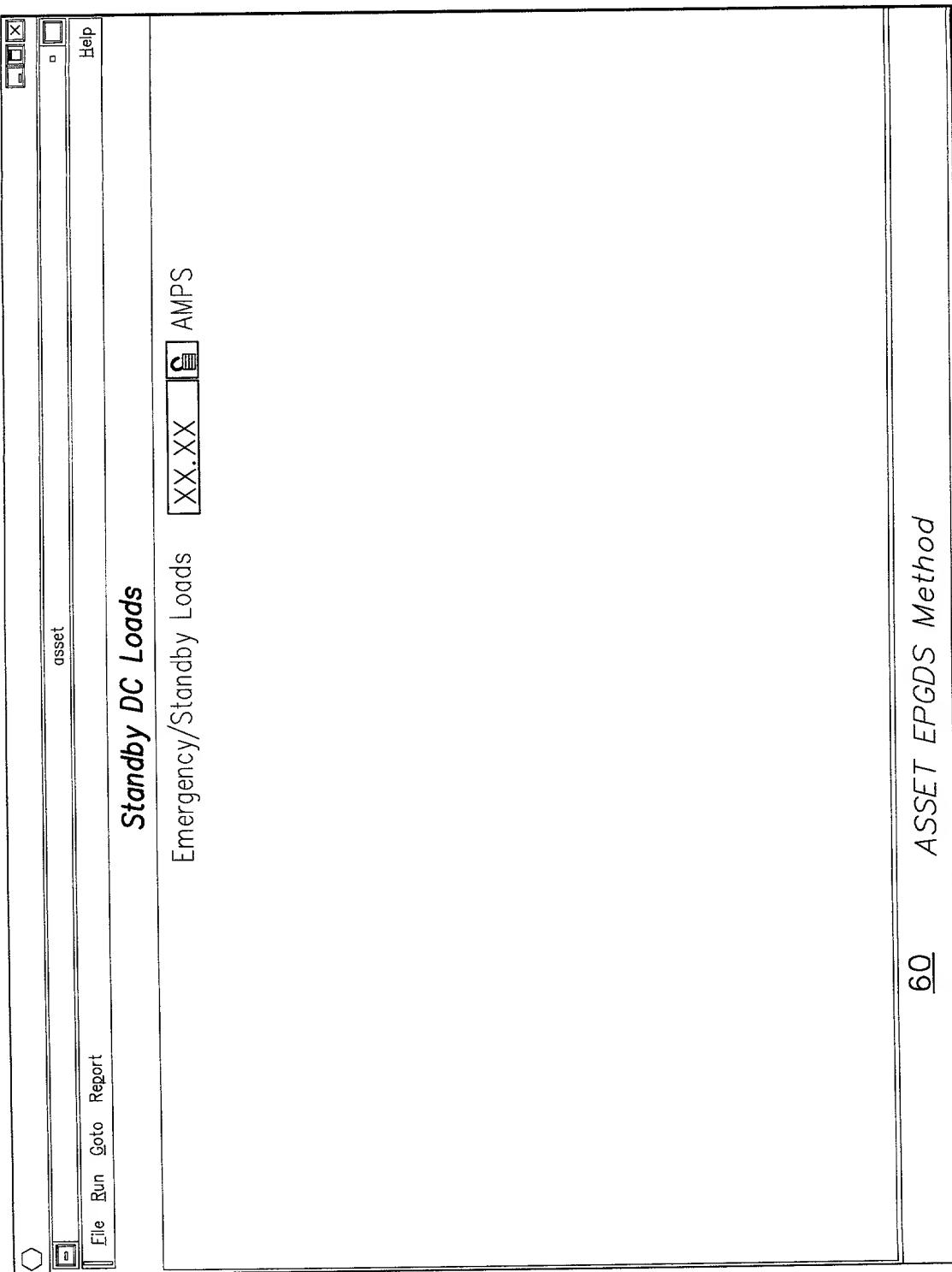


FIG. 12

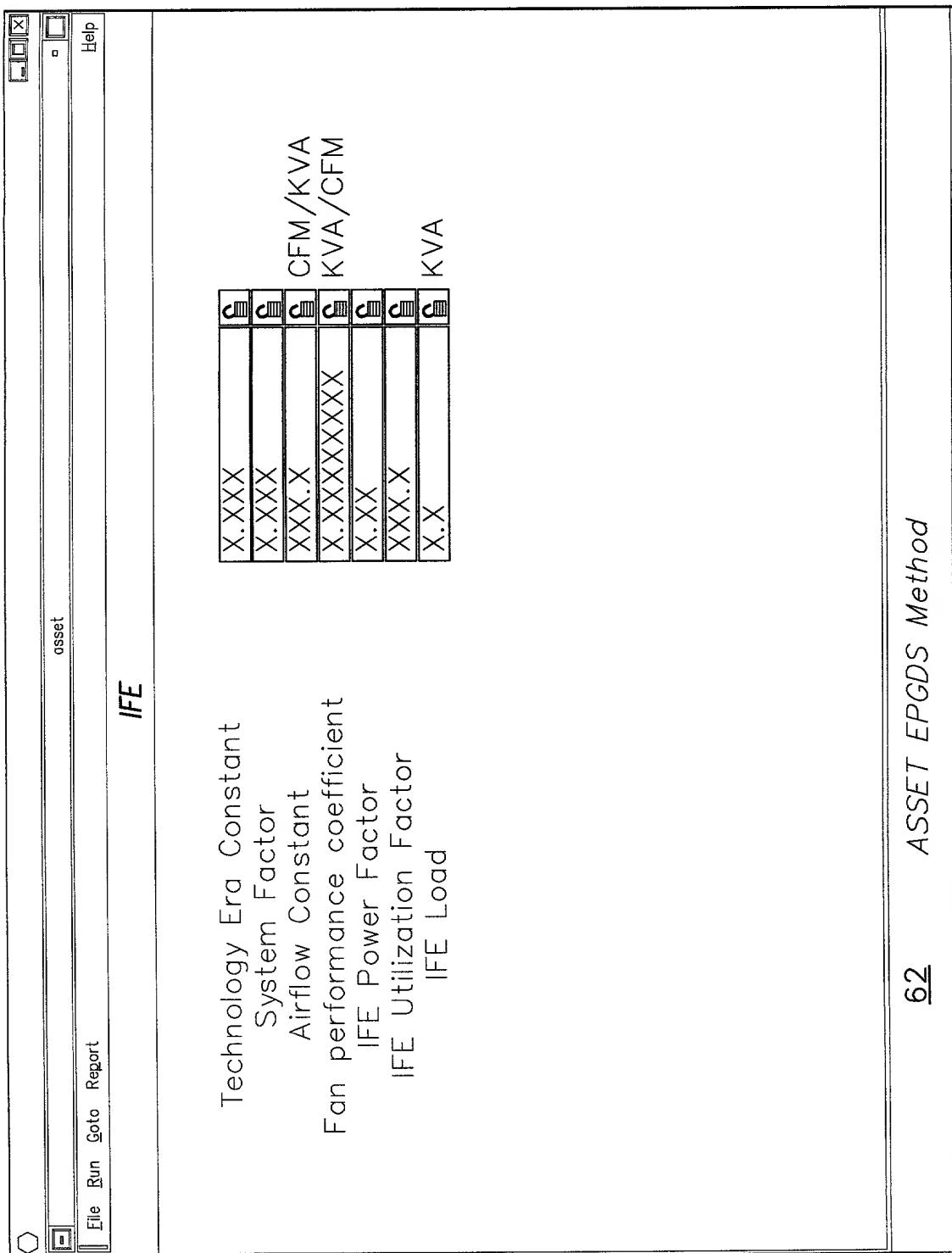


FIG. 13

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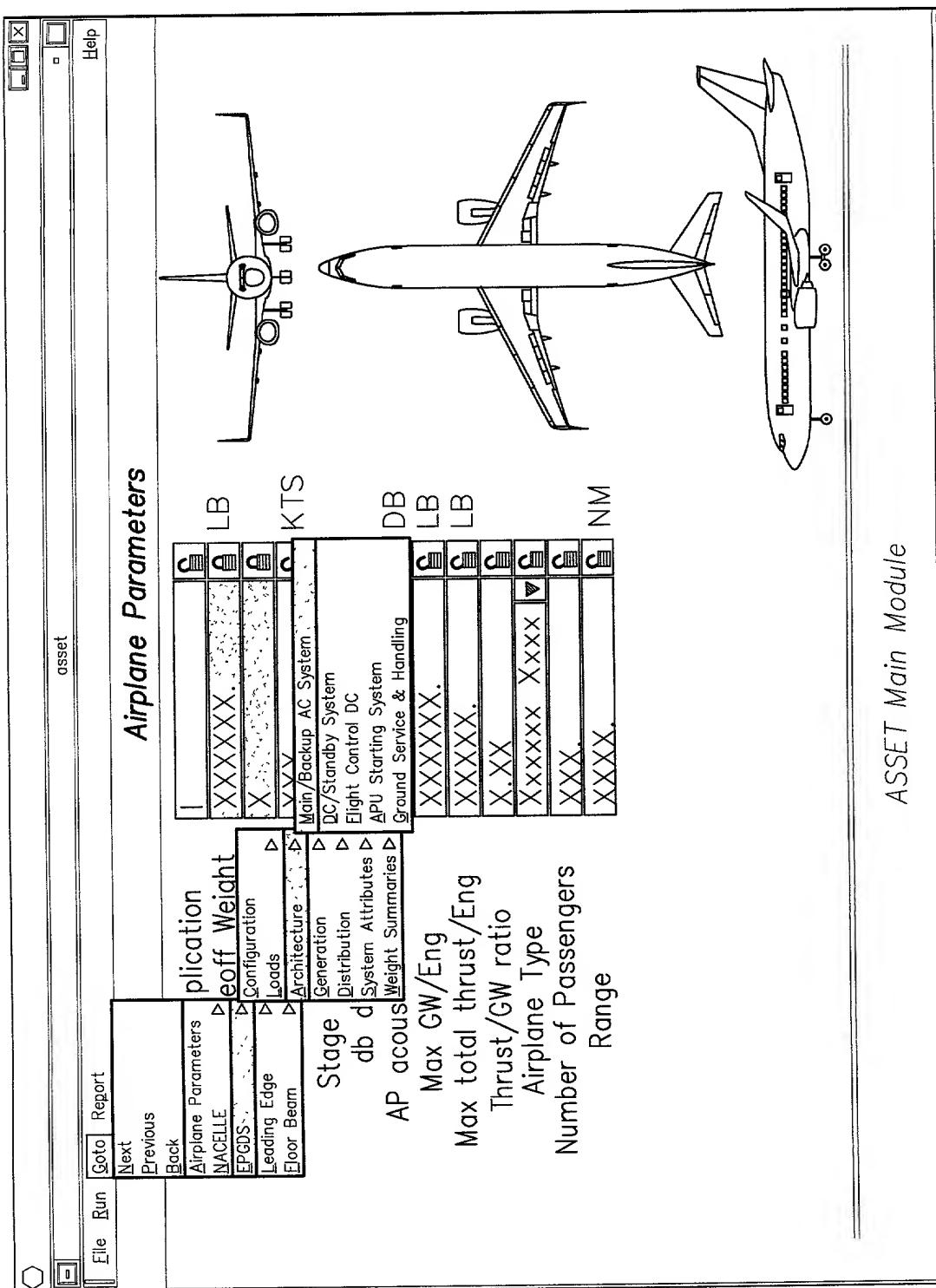


FIG. 14

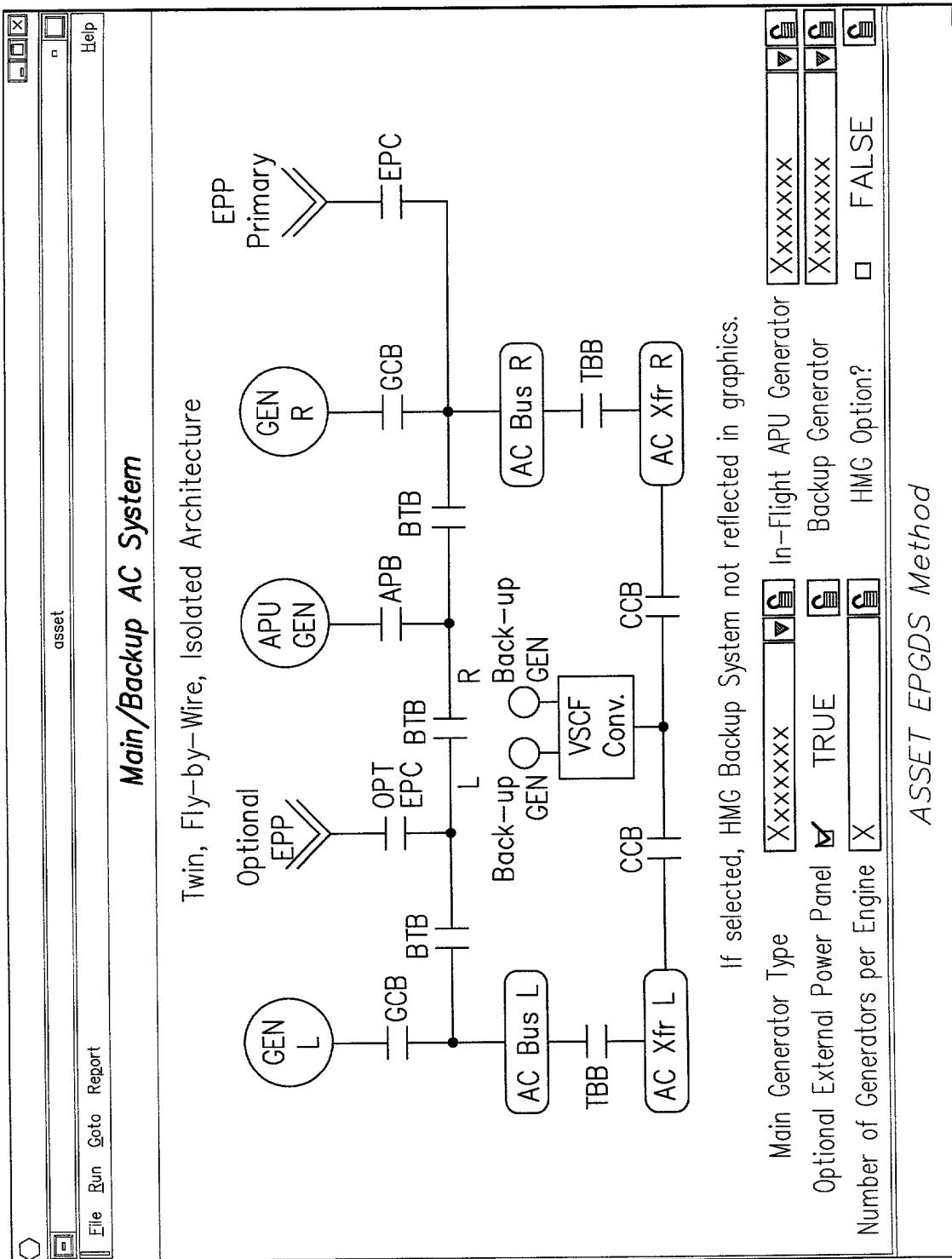
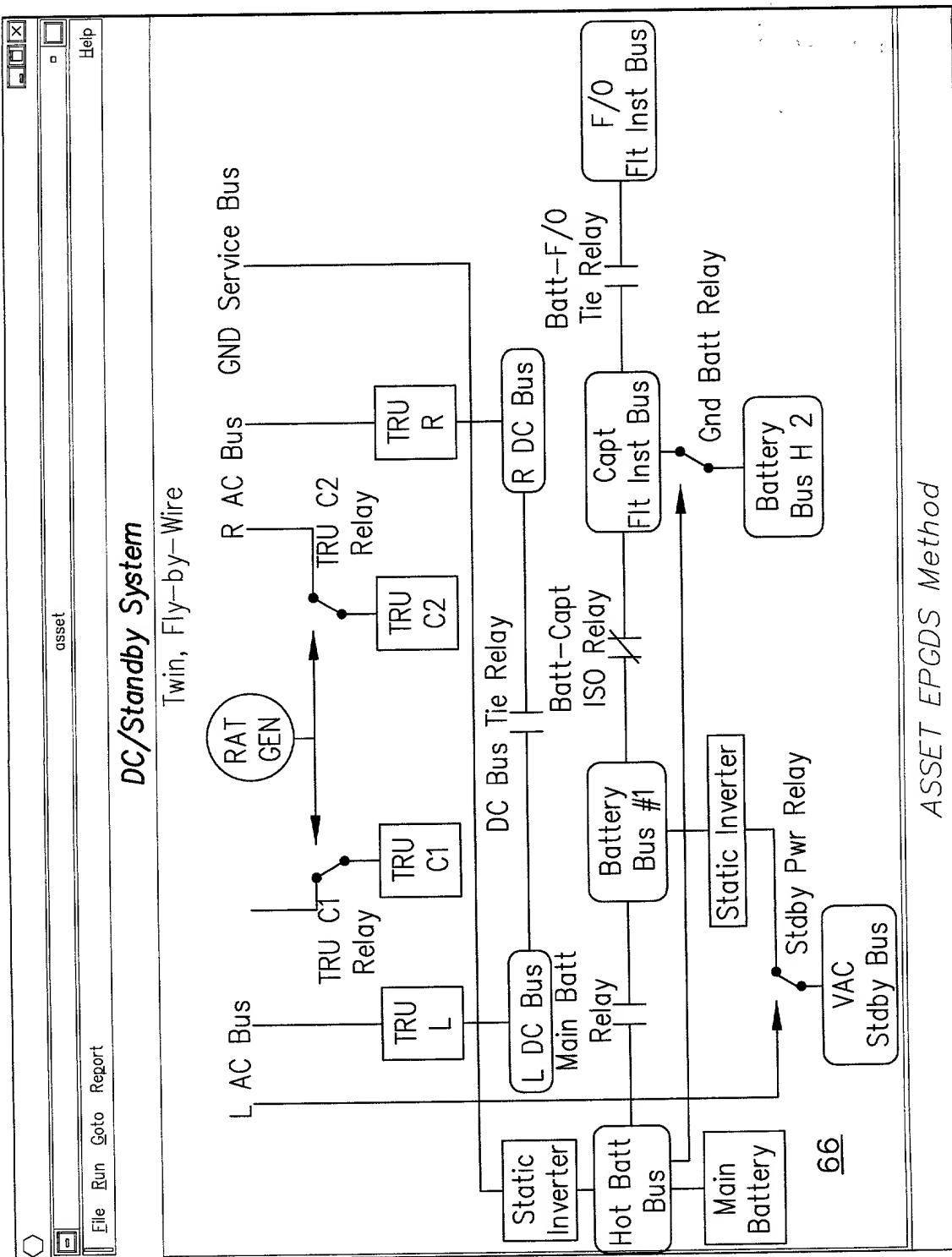
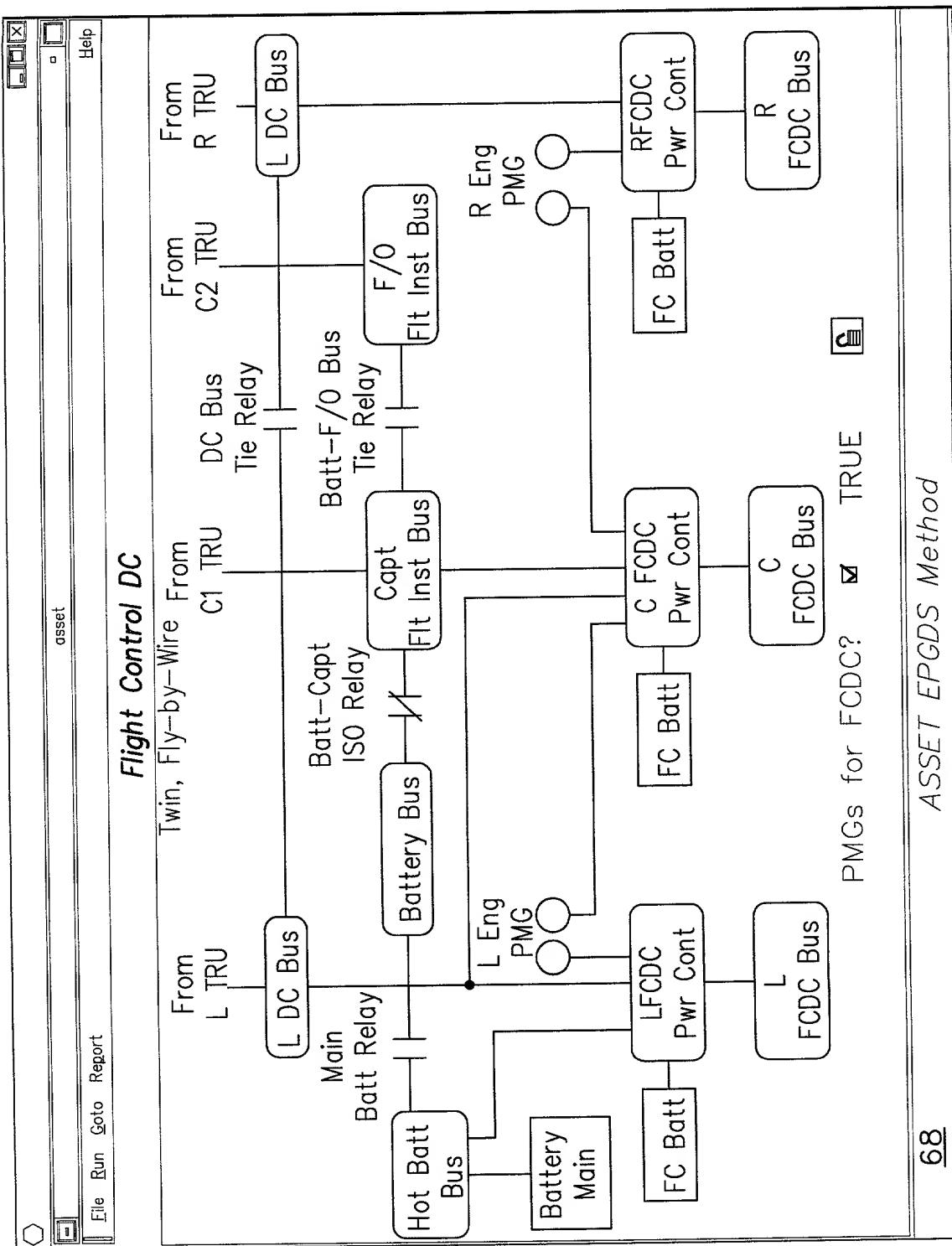


FIG. 15

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FIG.

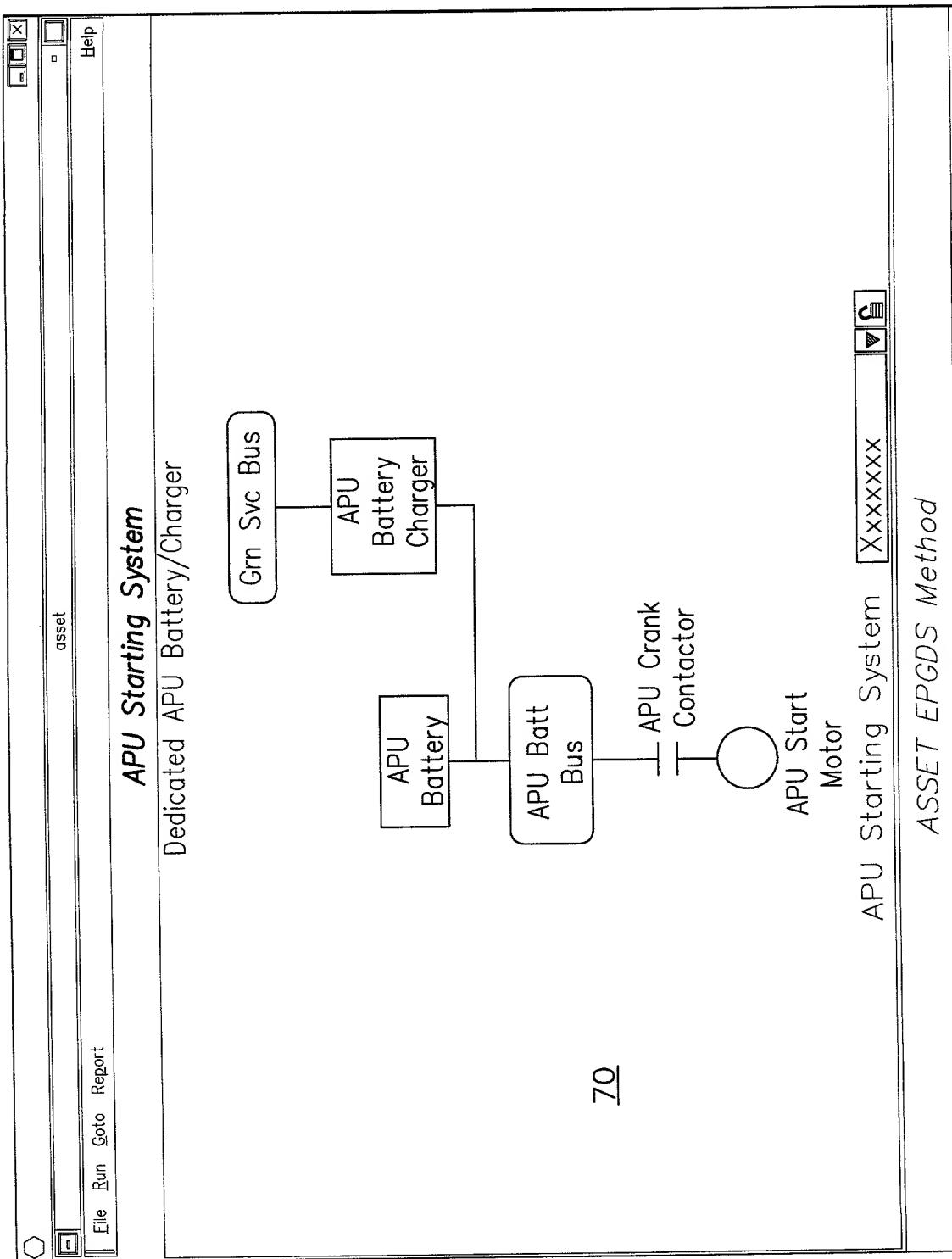
TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND  
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

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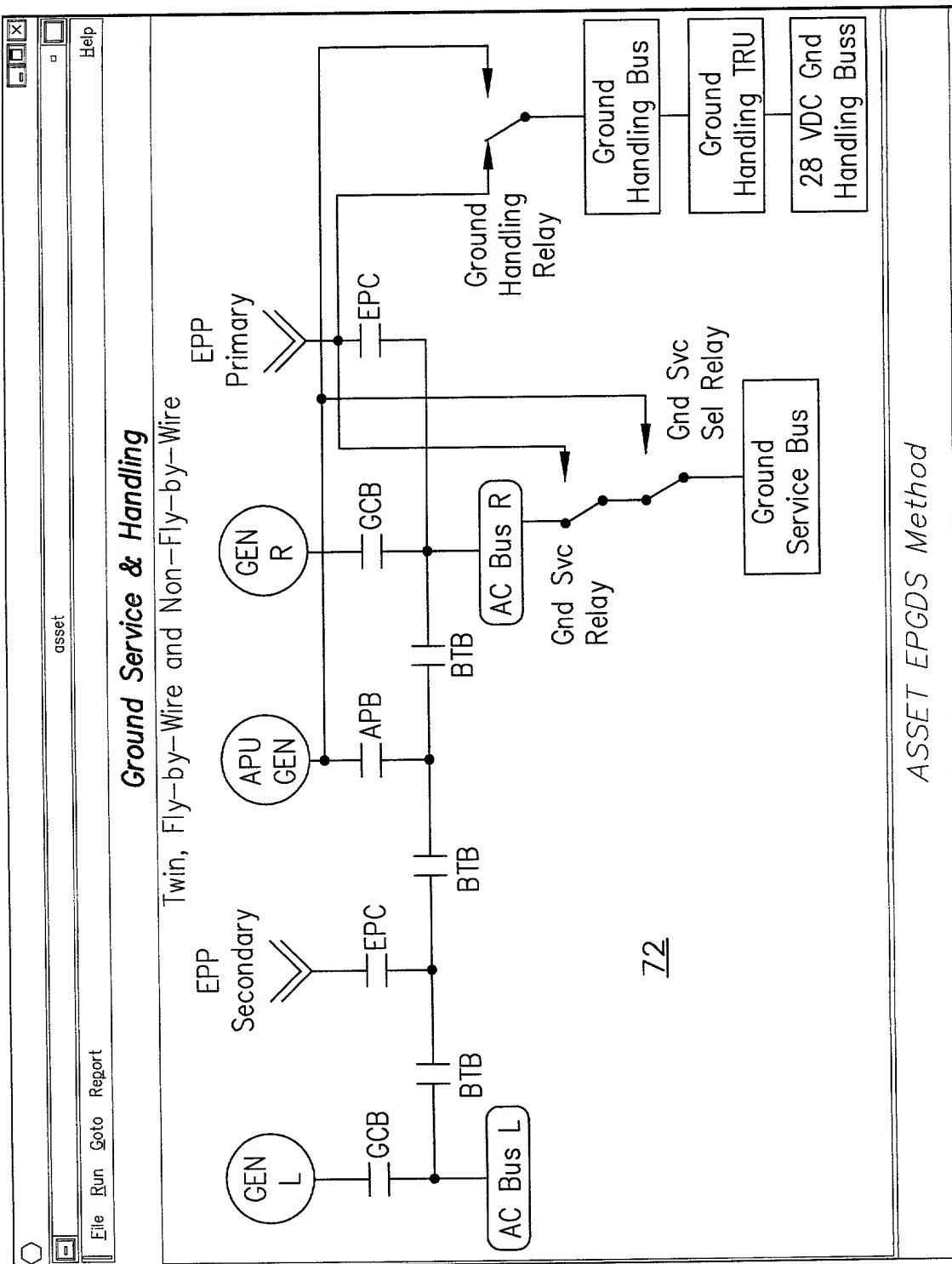


FIG. 19

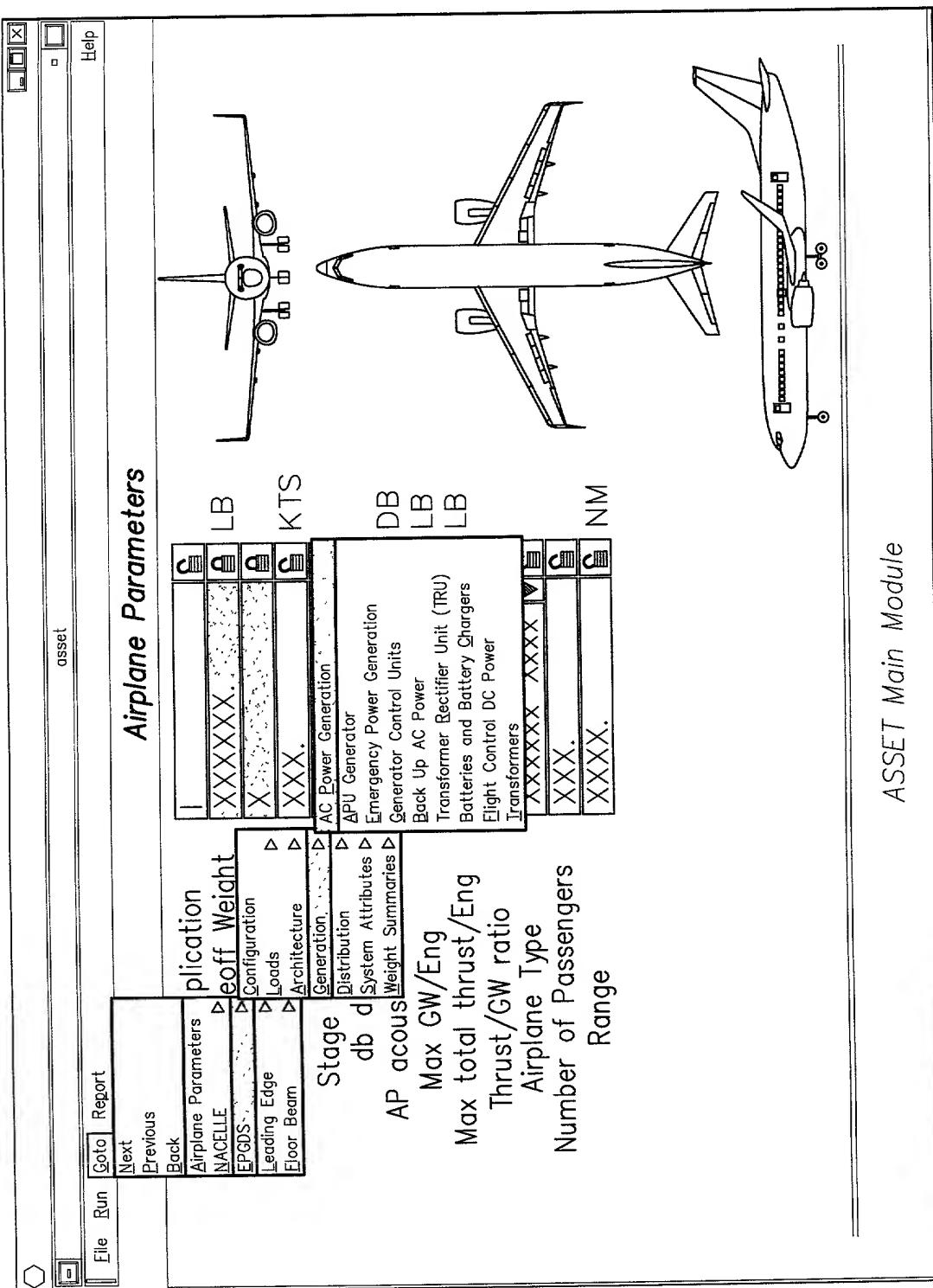


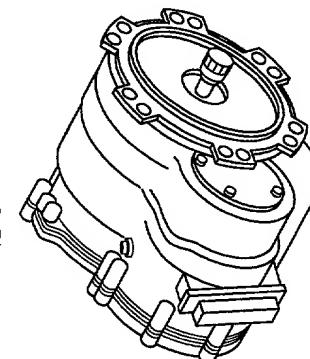
FIG. 20

asset

File Run Goto Report Help

**AC Power Generation**

IDG



| Generator Input Speed          | XXXXXX. | RPM |
|--------------------------------|---------|-----|
| Method of Cooling              | Xxxxxxx | ▼   |
| Generator Capacity             | XXX.X   | ▲   |
| Main AC Power Generator Weight | XXX.XX  | ▼   |
| VSCF Converter Config.         | Xxxxxxx | ▼   |
| Maximum Converter Load         | X.X     | ▲   |
| Main Converter Unit Weight     | XX.X    | ▼   |

| ATA            | Chapter | Section | Title                         | Motor Controller Load KVA | Motor Controller Weight LB |
|----------------|---------|---------|-------------------------------|---------------------------|----------------------------|
| ◇              | ◇       | ◇       | ◇                             | ◇ X.X                     | ◇ X.X                      |
| ◇              | ◇       | ◇       | ◇                             | ◇ X.X                     | ◇ X.X                      |
| ◇              | ◇       | ◇       | ◇                             | ◇ X.X                     | ◇ X.X                      |
| ◇              | ◇       | ◇       | ◇                             | ◇ X.X                     | ◇ X.X                      |
| ◇              | ◇       | ◇       | ◇                             | ◇ X.X                     | ◇ X.X                      |
| ◇              | ◇       | ◇       | ◇                             | ◇ X.X                     | ◇ X.X                      |
| ◇              | ◇       | ◇       | ◇                             | ◇ X.X                     | ◇ X.X                      |
| ◇              | ◇       | ◇       | ◇                             | ◇ X.X                     | ◇ X.X                      |
| IDG Hydraulics | Xxxxxxx | ▼       | Total Motor Controller Weight | XXX.X                     | ▲                          |

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FIG. 21

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND  
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

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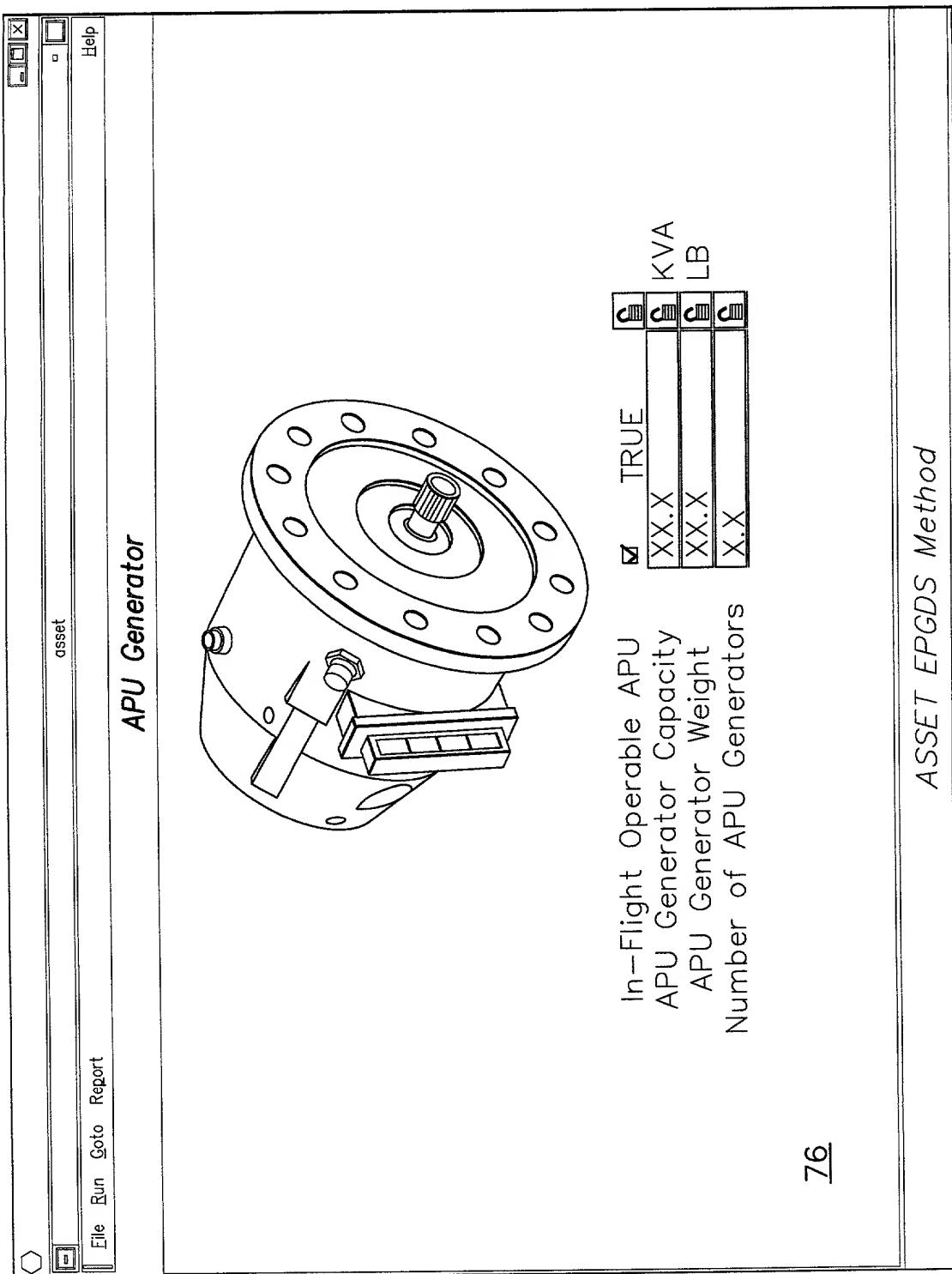


FIG. 22

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND  
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

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ASSET EPGDS Method

Generator Control Units

File Run Goto Report Asset Help

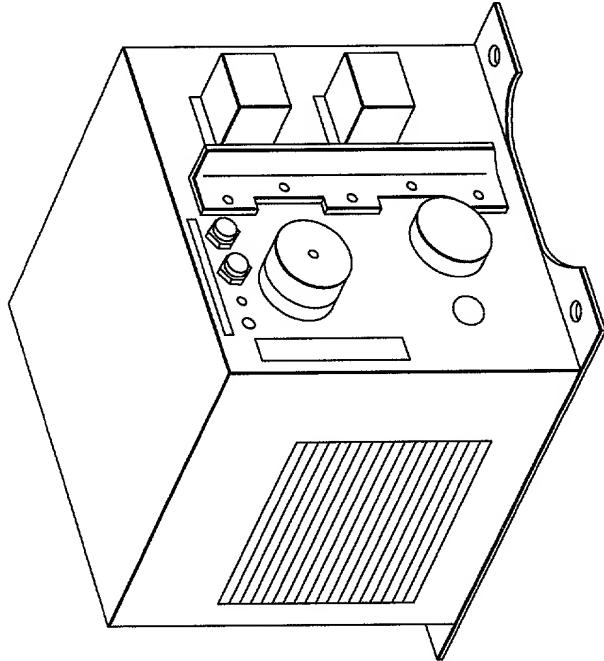
MAIN AC

|     |    |     |
|-----|----|-----|
| X.X | <> | APU |
| X.X | <> | RAT |
| X.X | <> | MCU |
| X.X | <> | LB  |

Unit Size

|     |    |     |
|-----|----|-----|
| X.X | <> | APU |
| X.X | <> | RAT |
| X.X | <> | MCU |
| X.X | <> | LB  |

Unit Weight



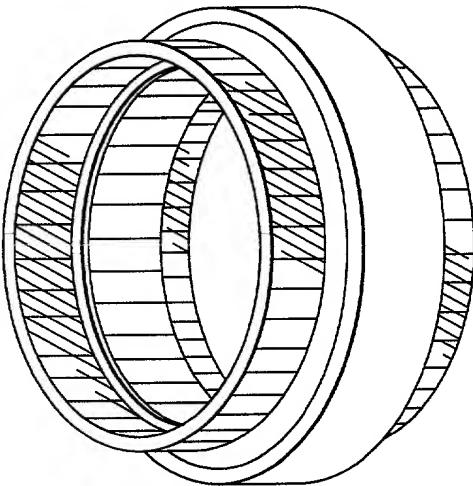
23

asset

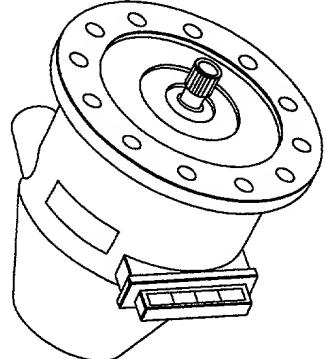
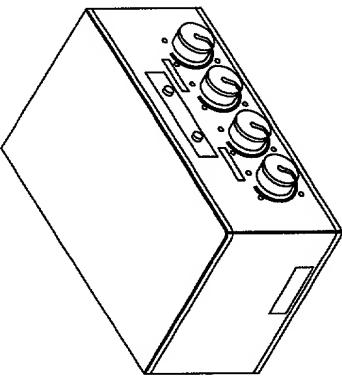
File Run Goto Report Help

**Back Up AC Power**

PMGS



VSCF



Generator Type  
Capacity  
Cooling Method  
Input speed  
Generator Weight

|          |   |     |
|----------|---|-----|
| XXXXXX   | ▼ | KVA |
| XX.X     | ▼ |     |
| XXXXXX   | ▼ | RPM |
| XXXXXX.X | ▼ | LB  |
| XX.X     | ▼ |     |

Number/Engine  
PMG Configuration  
PMG Unit Weight

|        |   |    |
|--------|---|----|
| XXXXXX | ▼ | LB |
| XX.X   | ▼ | LB |

Converter Configuration  
Converter Weight

|        |   |    |
|--------|---|----|
| XXXXXX | ▼ | LB |
| XX.X   | ▼ | LB |

ASSET EPGDS Method

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**FIG. 24**

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND  
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

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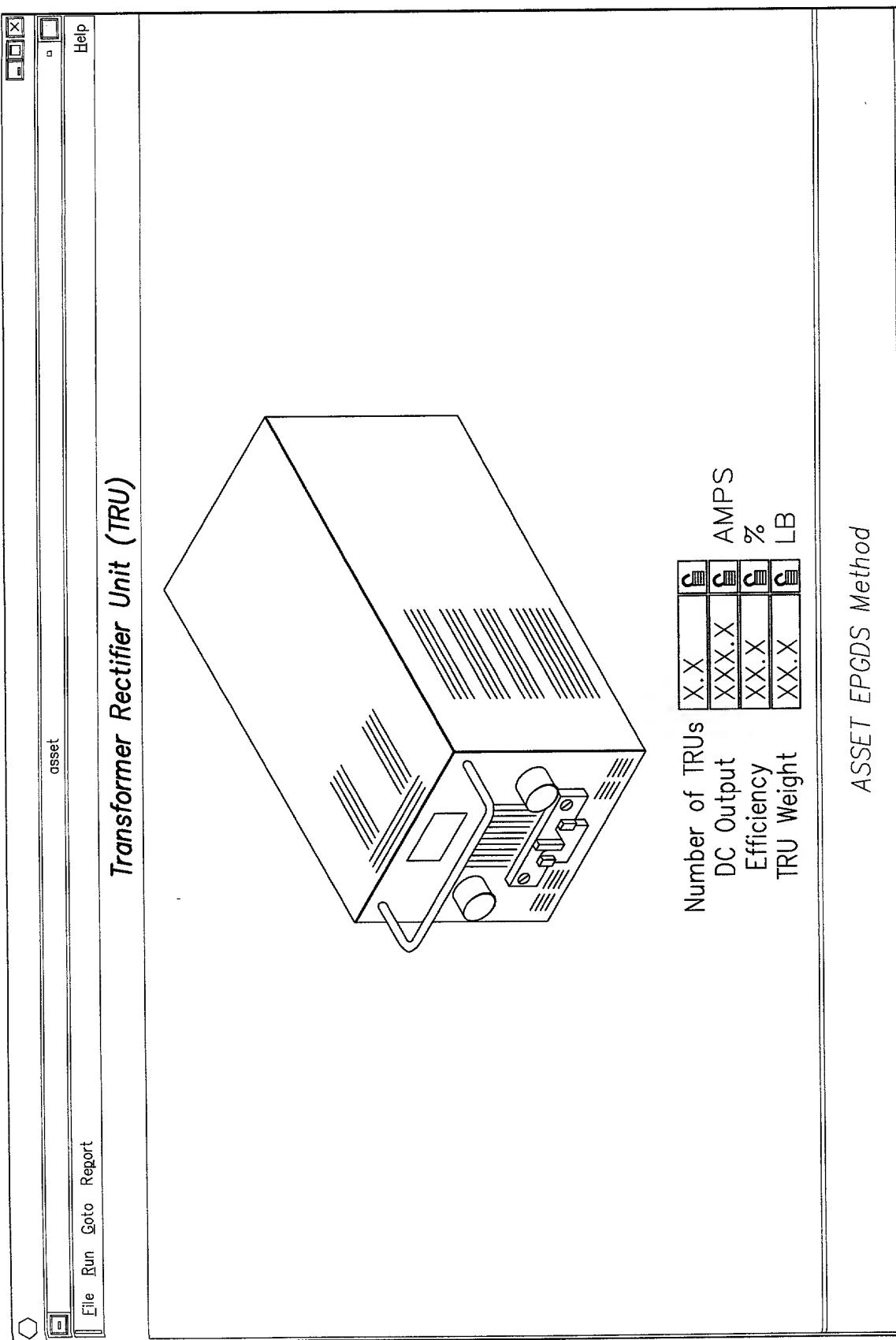
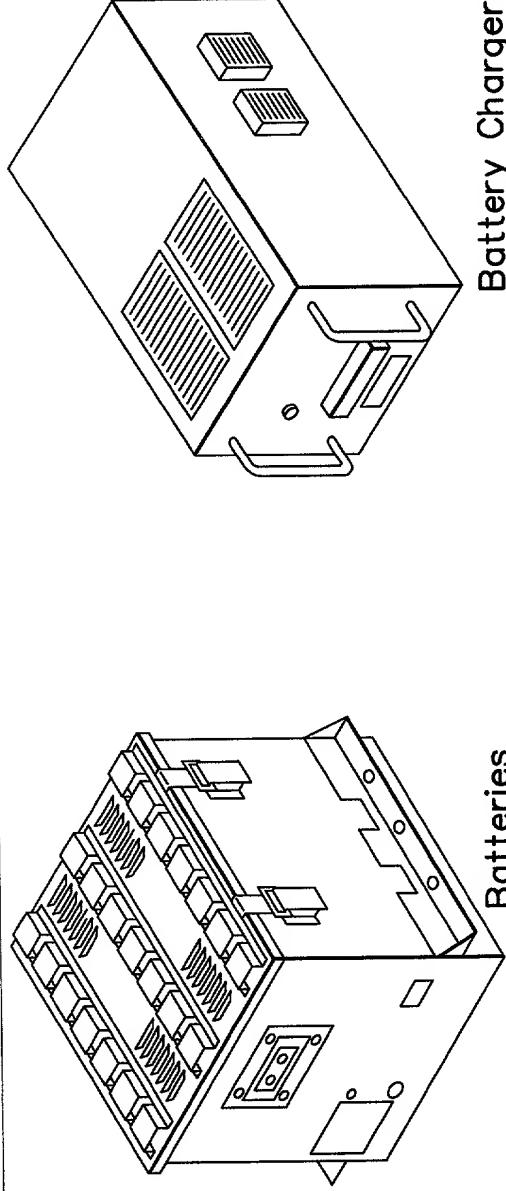


FIG. 25

asset

File Run Goto Report Help

### Batteries and Battery Chargers



**Batteries**

**Battery Chargers**

|                  | MAIN Battery | Output Capacity | AMPS  |
|------------------|--------------|-----------------|-------|
|                  | AMP-HRS      | Battery Charger | LB    |
| Nominal Capacity | XXX.X        | XXX.X           | XXX.X |
| Battery Weight   | LB           | LB              | LB    |

|                  | APU Battery | Output Capacity | AMPS  |
|------------------|-------------|-----------------|-------|
|                  | AMP-HRS     | Battery Charger | LB    |
| Nominal Capacity | XXX.X       | XXX.X           | XXX.X |
| Battery Weight   | LB          | LB              | LB    |

ASSET EPGDS Method

FIG. 26

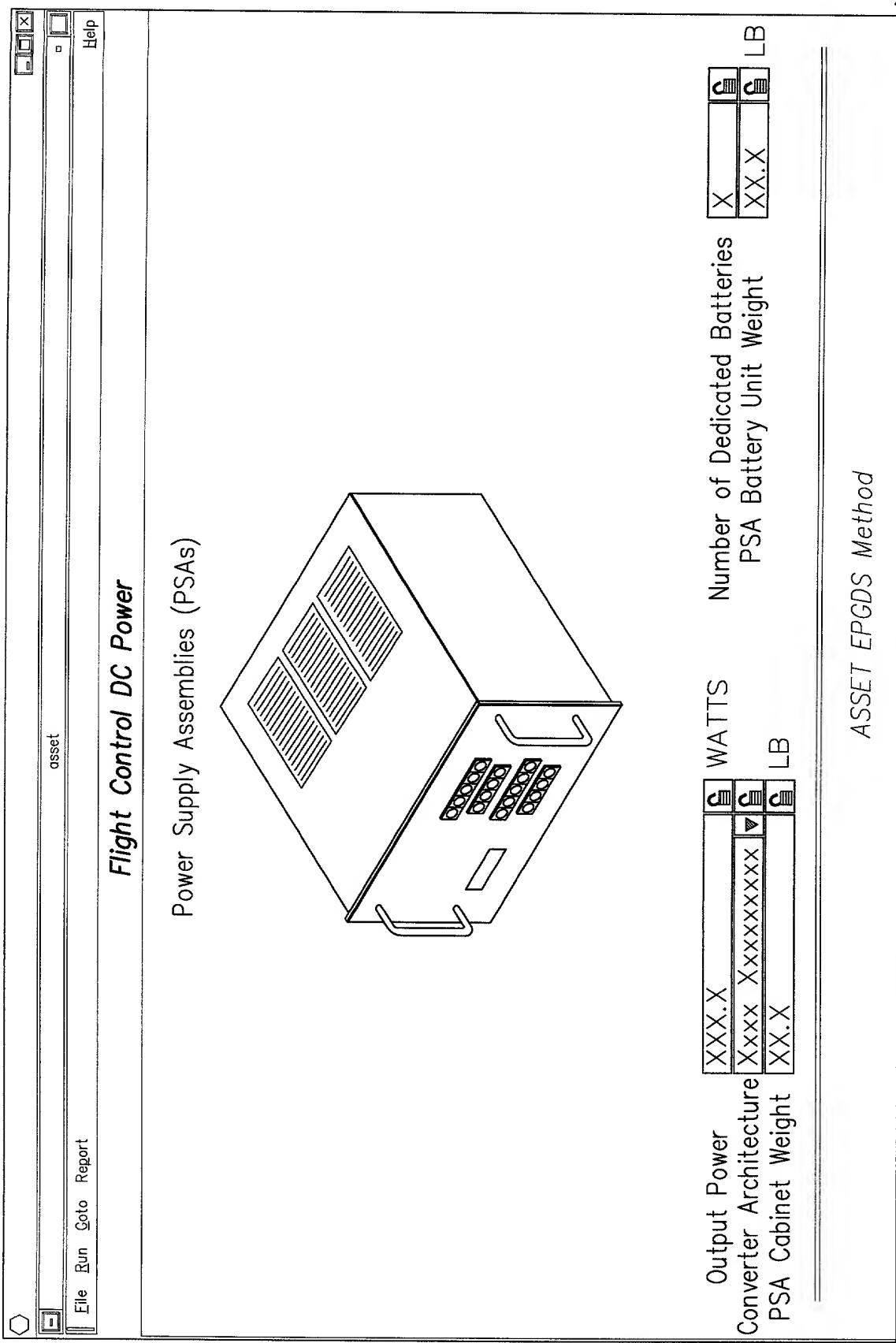
TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND  
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

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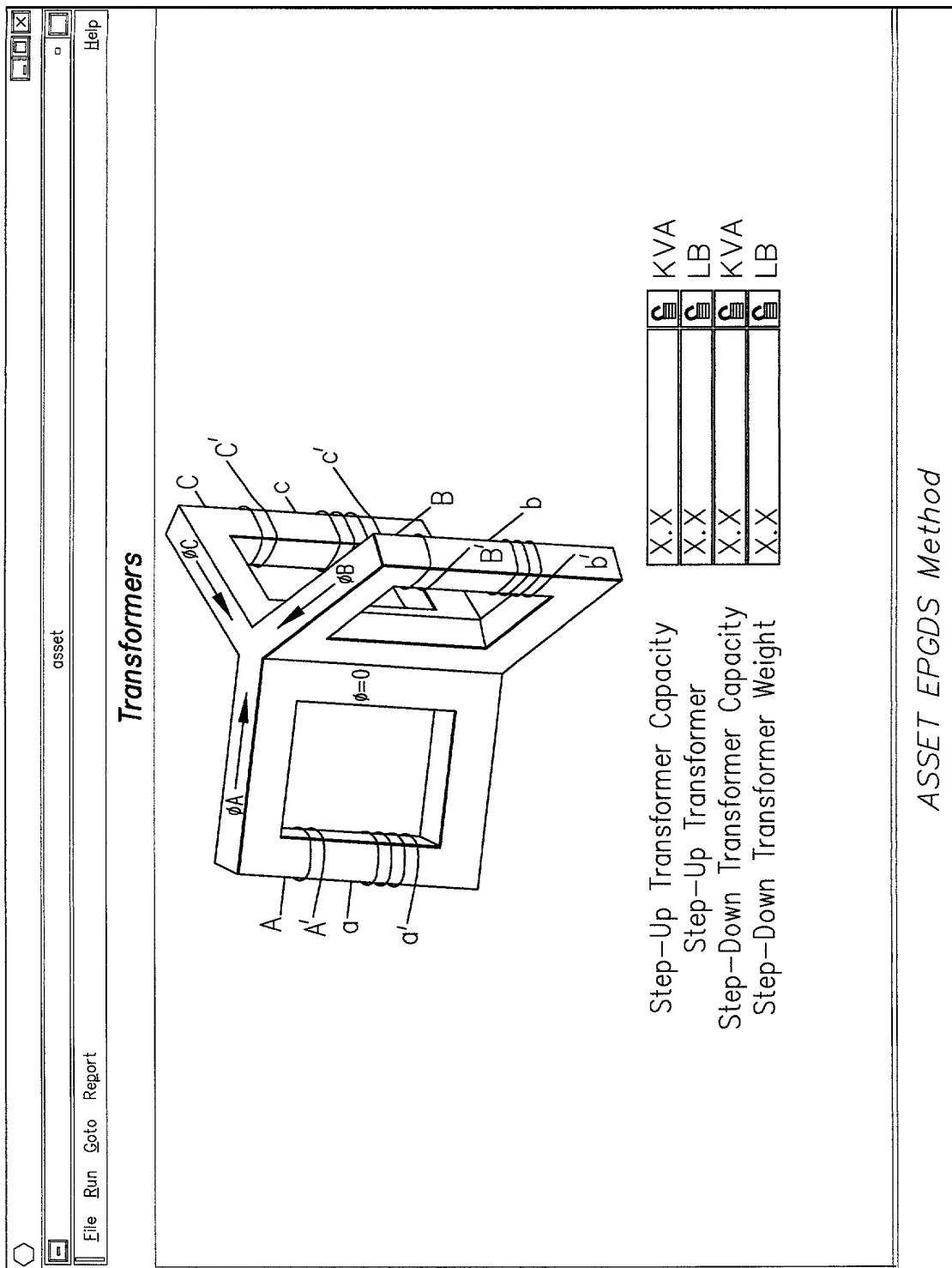


FIG. 28

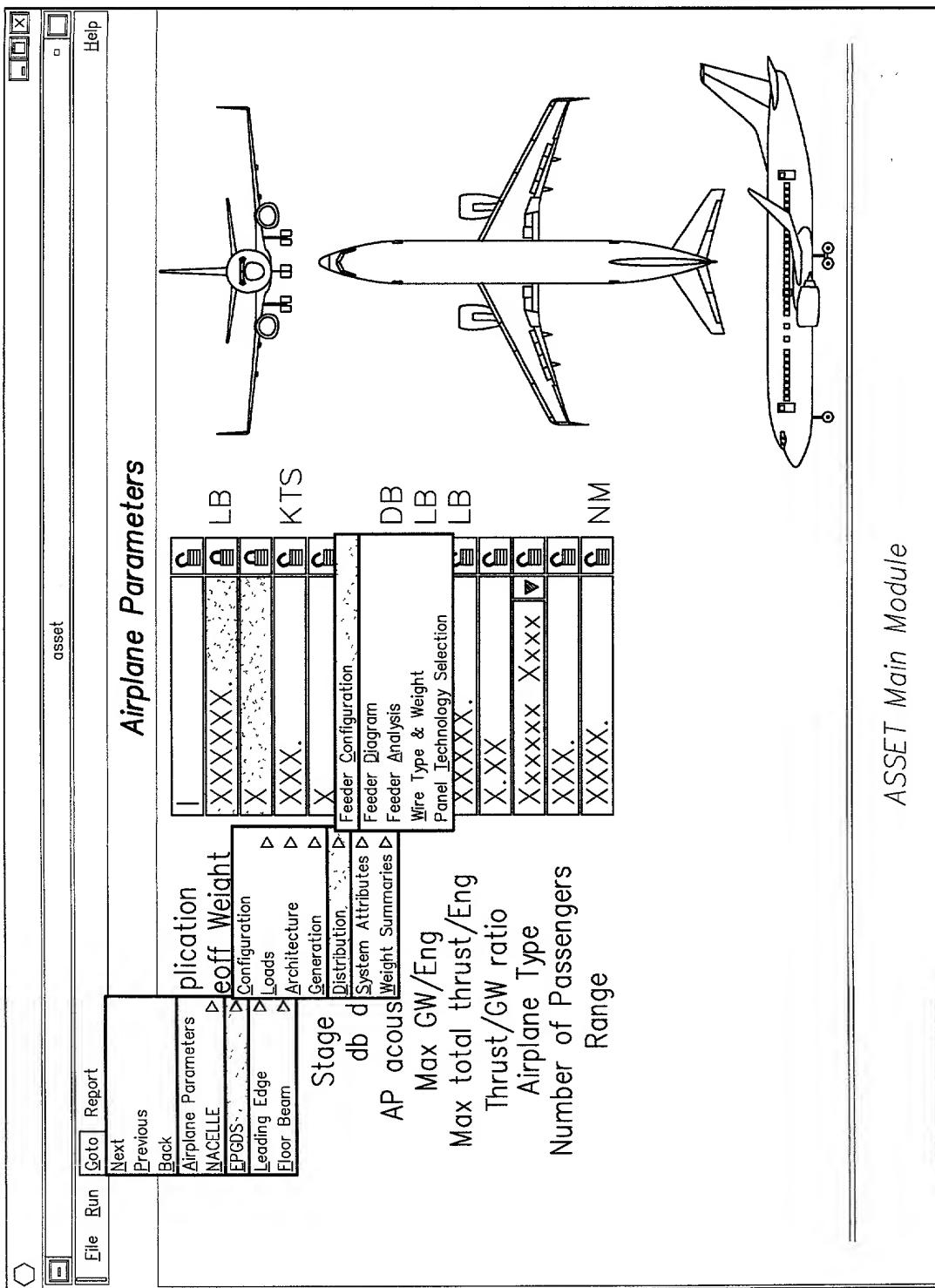


FIG. 29

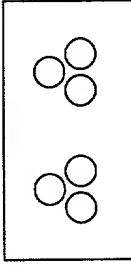
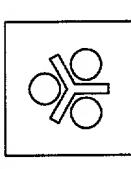
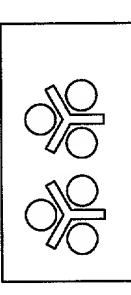
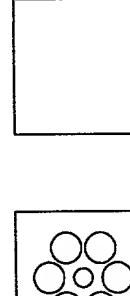
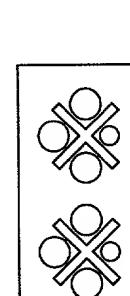
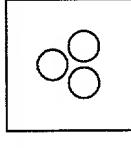
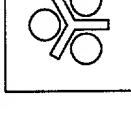
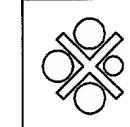
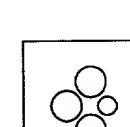
File Run Goto Report asset Help

Show Data for: XXXX ▶

**Feeder Configuration**

|           |                   |   |
|-----------|-------------------|---|
| Feeder 1: | < > X-XXXX X/XXXX | ▼ |
| Feeder 2: | < > X-XXXX X/XXXX | ▼ |
| Feeder 3: | < > X-XXXX X/XXXX | ▼ |
| Feeder 4: | < > X-XXXX X/XXXX | ▼ |
| Feeder 5: | < > XXXX          | ▼ |

**Bundle Cross-Sections**

|                                                                                     |                                                                                     |                                                                                      |                                                                                      |                                                                                     |                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 3-Wire                                                                              | 3-Wire w/Spctr                                                                      | 2 3-Wire                                                                             | 2 3-Wire w/Spctr                                                                     | 6-Wire                                                                              | 6-Wire w/Spctr                                                                      |
|  |  |    |     |   |  |
|  |  |  |  |  |  |

3-Wire w/Ntrl w/Spctr 2 3-Wire w/Mtrl w/Spctr 2 3-Wire w/Ntrl w/Spctr 6-Wire w/Ntrl Blank

ASSET EPGDS Method

FIG. 30

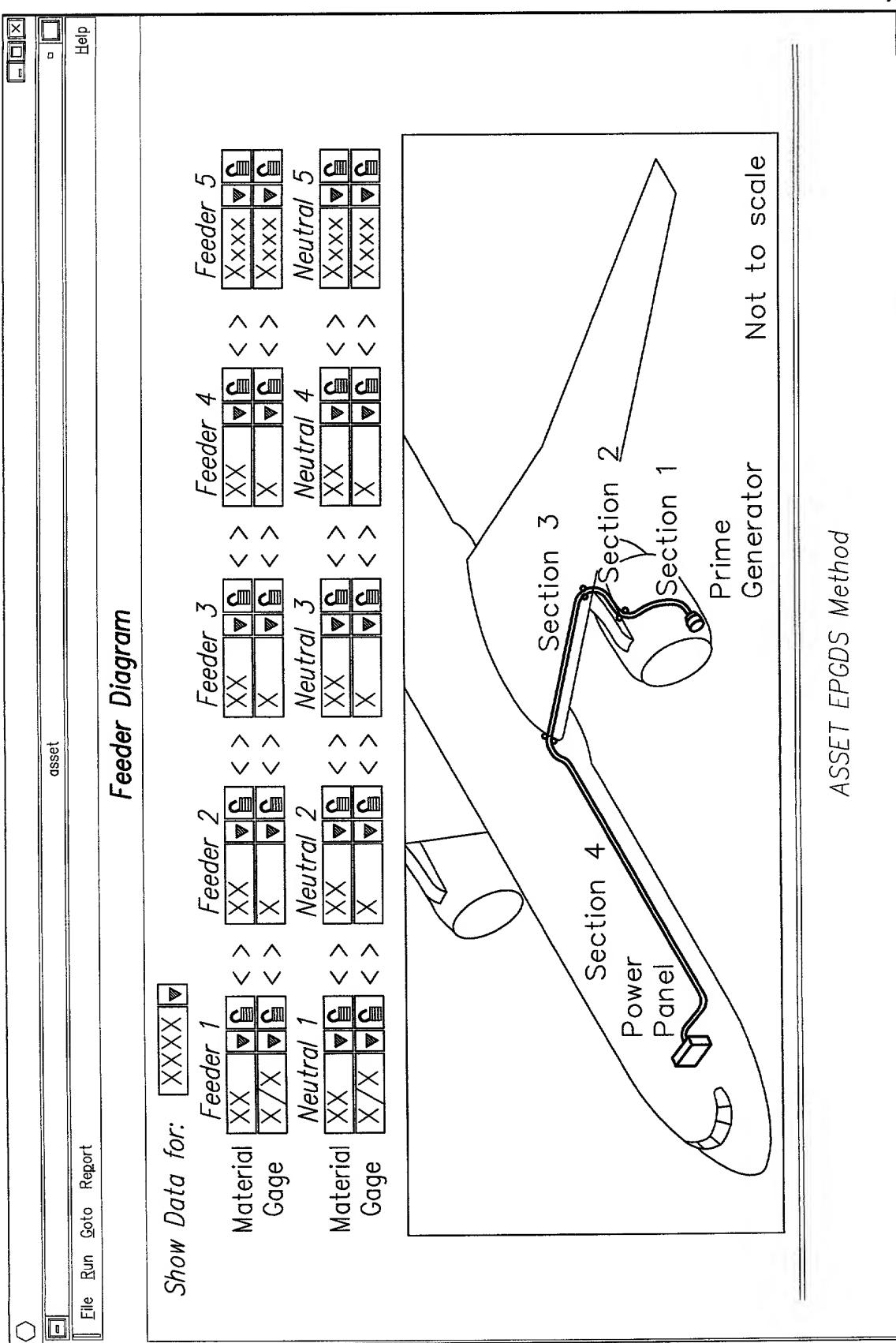


FIG. 31

FIG. 32

| Wire Type, Feeder 1:  | Feeder 1:          |
|-----------------------|--------------------|
| Wire Type, Neutral 1: | XX.X LB            |
| Wire Type, Feeder 2:  | XX.X LB            |
| Wire Type, Neutral 2: | XX.X LB            |
| Wire Type, Feeder 3:  | XX.X LB            |
| Wire Type, Neutral 3: | XX.X LB            |
| Wire Type, Feeder 4:  | XX.X LB            |
| Wire Type, Neutral 4: | XX.X LB            |
| Wire Type, Feeder 5:  | XX.X LB            |
| Wire Type, Neutral 5: | XX.X LB            |
|                       |                    |
| Show Data for: XXXX   | TRU Feeder Weight  |
|                       | XX.X LB            |
|                       |                    |
|                       | Total Wire Weight  |
|                       | XX.X LB            |
|                       |                    |
|                       | ASSET EPGDS Method |

FIG. 33

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND  
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

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ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

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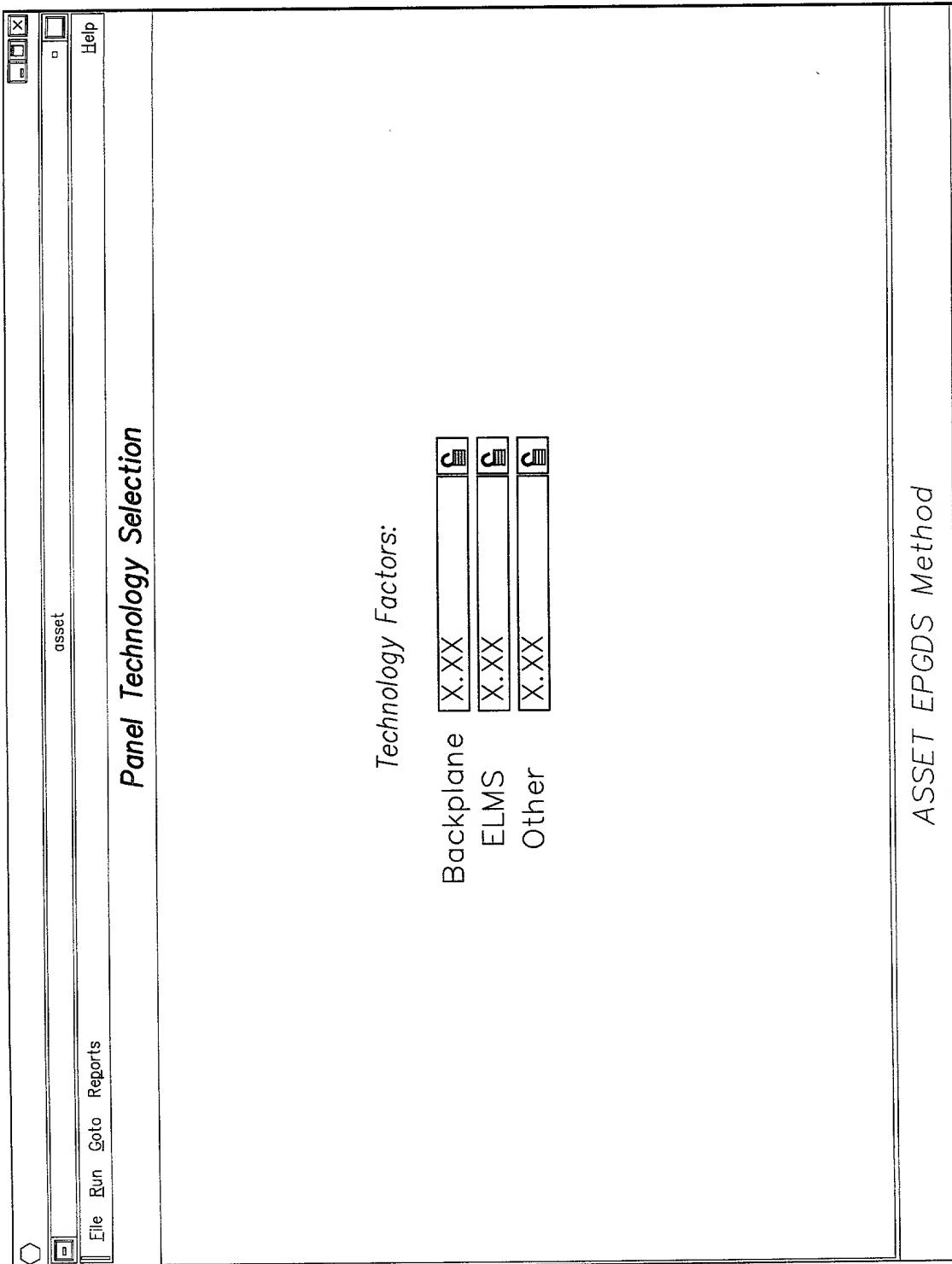


FIG. 34

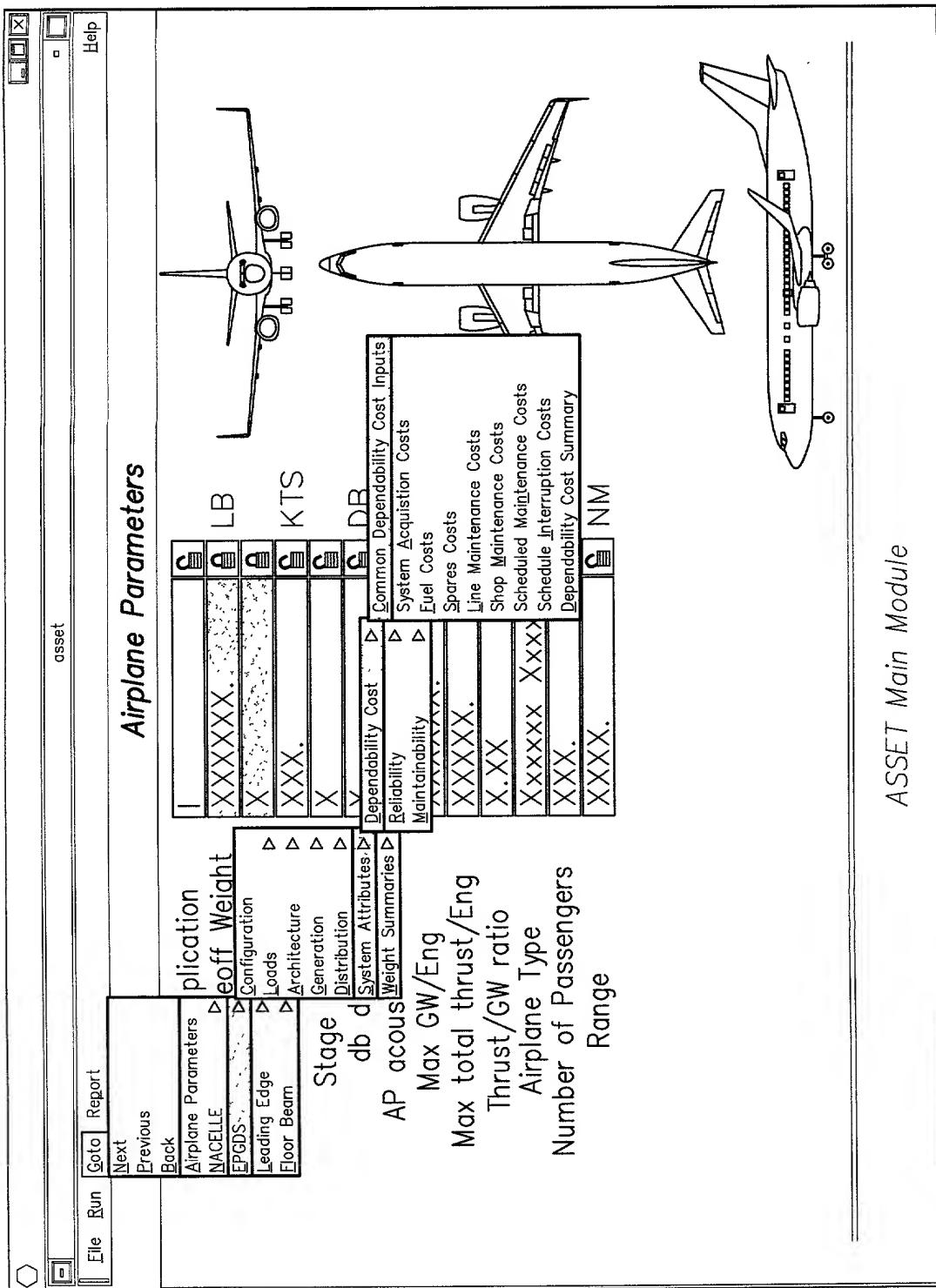


FIG. 35

ASSET EPGDS Method

Common Dependability Cost Inputs

|                                                     |        |
|-----------------------------------------------------|--------|
| Number of Main Generators per Airplane              | X      |
| Average Number of Flights per Year per Airplane     | XXXXX. |
| Average Flight Hours per Flight                     | XXX.X  |
| Airplane Feet Size                                  | XX     |
| Length of System Life in Years (1 – 30 Yrs.)        | XX     |
| Average Non-fuel Inflation Rate beyond Present Year | X.XXX  |
| Minimum Attractive Rate of Return                   | X.XX   |

ASSET

EPGDS

Method

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The screenshot shows a software application window titled "ASSET EPGDS Method". The menu bar includes "File", "Run", "Goto", "Report", and "Help". The main window is titled "System Acquisition Costs". On the left, there is a vertical toolbar with icons for "asset", "File", "Run", "Goto", "Report", and "Help". The main content area contains the following text and table:

System Acquisition Cost, Base Year (per fleet)  DOLLARS

System Support Equipment Cost, Base Year (per fleet)  DOLLARS

System Initial Training Cost, Base Year (per fleet)  DOLLARS

System Acquisition Cost per Airplane per Year  DOLLARS

FIG. 37

ASSET

File Run Goto Report Help

**Fuel Costs**

| Fuel cost per Gallon, Base Year                     | X.XX     | DOLLARS             |
|-----------------------------------------------------|----------|---------------------|
| Lbs Fuel Burned/Flight Hour/Lb Additional Weight    | X.XXXXXX | HRS <sup>^</sup> -1 |
| System Weight (per airplane)                        | XXX.X    | LB                  |
| System Direct Horsepower Requirement (per airplane) | X.       | HP                  |
| System Drag Horsepower Requirement (per airplane)   | X.       | HP                  |
| System Cooling Horsepower Requirement               | X.       | HP                  |
| System Pound of Fuel per Block Trip (per airplane)  | X.       | LB                  |
| Average Fuel Inflation Rate Beyond Present Year     | X.XXXX   | %                   |

| Fuel Cost (NPV of Life Cycle Cost) | XXXXXXX. | DOLLARS |
|------------------------------------|----------|---------|
| Fuel Cost per Airplane per Year    | XXXXX.   | DOLLARS |

ASSET EPGDS Method

ASSET

File Run Goto Report Help

**Spares Costs**

|                                              |                                       |                                        |
|----------------------------------------------|---------------------------------------|----------------------------------------|
| Cost/Spare Unit, Base Year                   | <input type="text" value="XXXXXX."/>  | <input type="text" value="DOLLARS"/>   |
| Spares Holding Factor                        | <input type="text" value="X.XX"/>     | <input type="text" value="C %"/>       |
| Shop Turnaround Time in Days                 | <input type="text" value="XXX.X"/>    | <input type="text" value="C DAYS"/>    |
| Main Base Fill Rate (must be less than 1)    | <input type="text" value="X.XX"/>     | <input type="text" value="C"/>         |
| Mean Time Between Unscheduled Removals       | <input type="text" value="XXXXXX."/>  | <input type="text" value="C HRS"/>     |
| Mean Time Between Overhauls                  | <input type="text" value="X."/>       | <input type="text" value="C HRS"/>     |
| Number of Spares Required                    | <input type="text" value="X."/>       | <input type="text" value="C"/>         |
| Initial Spares Cost                          | <input type="text" value="XXXXXXX."/> | <input type="text" value="C DOLLARS"/> |
| Spares Holding Cost (NPV of Life Cycle Cost) | <input type="text" value="XXXXXXX."/> | <input type="text" value="C DOLLARS"/> |
| Spares Cost (NPV of Life Cycle Cost)         | <input type="text" value="XXXXXXX."/> | <input type="text" value="C DOLLARS"/> |
| Spares Cost per Airplane per Year            | <input type="text" value="XXXXX."/>   | <input type="text" value="C DOLLARS"/> |

ASSET EPGDS Method

asset

File Run Goto Report Help

### Line Maintenance Costs

|                                                         | XXX.XXX  | XXX.DOLLARS/HOUR |
|---------------------------------------------------------|----------|------------------|
| Direct Labor Rate per Hour                              | XXX.XXX  | XXX.DOLLARS/HOUR |
| Maintenance Labor Burden Factor                         | XXX.X    | XXX.DOLLARS/HOUR |
| Mean Time Between Unscheduled Removals                  | XXX.XXX. | XXX.DOLLARS/HOUR |
| Line Labor Hours Required per Removal                   | XXX.X    | XXX.DOLLARS/HOUR |
| Line Labor Hours per Maintenance Action (Non-Removal)   | XXX.X    | XXX.DOLLARS/HOUR |
| Maintenance Actions per 1000 Flight Hours (Non-Removal) | XXX.XXX  | XXX.DOLLARS/HOUR |
|                                                         |          |                  |
| Line Maintenance Cost (NPV of Life Cycle Cost)          | XXXXXX.  | XXX.DOLLARS      |
| Line Maintenance Cost per Airplane per Year             | XXX.XXX. | XXX.DOLLARS      |

ASSET EPGDS Method

| Shop Maintenance Costs                                   |                                         |
|----------------------------------------------------------|-----------------------------------------|
| Direct Labor Rate per Hour                               | XX.XX <input type="text"/> DOLLARS/HOUR |
| Maintenance Labor Burden Factor                          | X.X <input type="text"/> HRS            |
| Mean Time Between Unscheduled Removals                   | XXXXXX. <input type="text"/> HRS        |
| Main Generator Mean Time Between Failures                | XXXXXX. <input type="text"/> HRS        |
| Mean Time Between Overhauls                              | X. <input type="text"/> HRS             |
| Shop Labor Man-Hours per Unconfirmed Failure (Test Time) | XX.X <input type="text"/> HRS           |
| Shop Labor Man-Hours per Failure (Repair and Test)       | XXX.X <input type="text"/> HRS          |
| Shop Labor Hours per Overhaul                            | X.X <input type="text"/> HRS            |
| Average Shop Material Cost per Failure, base year        | XXXXXX. <input type="text"/> DOLLARS    |
| Overhaul Materials Cost per Overhaul                     | X. <input type="text"/> DOLLARS         |
|                                                          |                                         |
| Shop Maintenance Cost (NPV of Life Cycle Cost)           | XXXXXXXXX. <input type="text"/> DOLLARS |
| Shop Maintenance Cost per Airplane per Year              | XXXXXX. <input type="text"/> DOLLARS    |
|                                                          |                                         |
| ASSET EPGDS Method                                       |                                         |

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FIG.

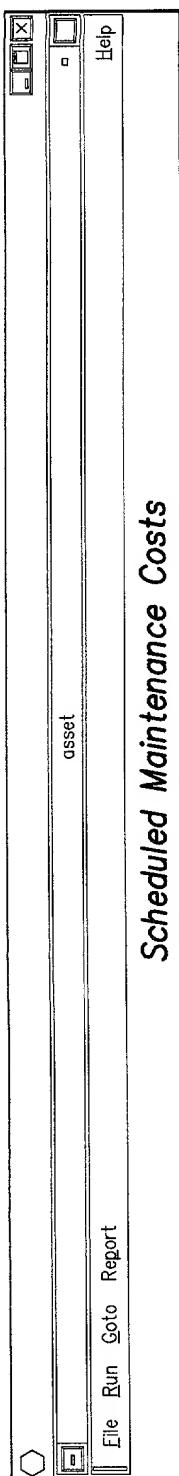
|                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                            |                                                  |                                 |                                                                 |                                        |                                          |                                               |                                                                  |                   |                                                                  |                                               |                                                                  |                                            |                                                                  |                   |                                                                     |                                                  |                                              |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------------------------------------|---------------------------------|-----------------------------------------------------------------|----------------------------------------|------------------------------------------|-----------------------------------------------|------------------------------------------------------------------|-------------------|------------------------------------------------------------------|-----------------------------------------------|------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------|-------------------|---------------------------------------------------------------------|--------------------------------------------------|----------------------------------------------|
|  | <p><b>Scheduled Maintenance Costs</b></p> <table><tr><td>Direct Labor Rate per Hour</td><td><input type="text" value="XXX.XX"/> DOLLARS/HOUR</td></tr><tr><td>Maintenance Labor Burden Factor</td><td><input type="text" value="X.X"/> <input type="text" value="C"/></td></tr><tr><td>Mean Time Between Unscheduled Removals</td><td><input type="text" value="XXXXXX."/> HRS</td></tr><tr><td>Schedule Maintenance Inspection Man Hours per</td><td><input type="text" value="X.XX"/> <input type="text" value="C"/></td></tr><tr><td>1000 Flight Hours</td><td><input type="text" value="X.XX"/> <input type="text" value="C"/></td></tr><tr><td>Rectification Man Hours per 1000 Flight Hours</td><td><input type="text" value="X.XX"/> <input type="text" value="C"/></td></tr><tr><td>Scheduled Maintenance Material Dollars per</td><td><input type="text" value="X.XX"/> <input type="text" value="C"/></td></tr><tr><td>1000 Flight Hours</td><td><input type="text" value="HRS^ -1"/> <input type="text" value="C"/></td></tr></table> <p>Scheduled Maintenance Cost (NPV of Life Cycle Cost)</p> <p>Scheduled Maintenance Cost per Airplane per Year</p> <table><tr><td><input type="text" value="XXXXXXXXXX."/> DOLLARS</td></tr><tr><td><input type="text" value="XXXXXX."/> DOLLARS</td></tr></table> <p>ASSET EPGDS Method</p> | Direct Labor Rate per Hour | <input type="text" value="XXX.XX"/> DOLLARS/HOUR | Maintenance Labor Burden Factor | <input type="text" value="X.X"/> <input type="text" value="C"/> | Mean Time Between Unscheduled Removals | <input type="text" value="XXXXXX."/> HRS | Schedule Maintenance Inspection Man Hours per | <input type="text" value="X.XX"/> <input type="text" value="C"/> | 1000 Flight Hours | <input type="text" value="X.XX"/> <input type="text" value="C"/> | Rectification Man Hours per 1000 Flight Hours | <input type="text" value="X.XX"/> <input type="text" value="C"/> | Scheduled Maintenance Material Dollars per | <input type="text" value="X.XX"/> <input type="text" value="C"/> | 1000 Flight Hours | <input type="text" value="HRS^ -1"/> <input type="text" value="C"/> | <input type="text" value="XXXXXXXXXX."/> DOLLARS | <input type="text" value="XXXXXX."/> DOLLARS |
| Direct Labor Rate per Hour                                                         | <input type="text" value="XXX.XX"/> DOLLARS/HOUR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                                                  |                                 |                                                                 |                                        |                                          |                                               |                                                                  |                   |                                                                  |                                               |                                                                  |                                            |                                                                  |                   |                                                                     |                                                  |                                              |
| Maintenance Labor Burden Factor                                                    | <input type="text" value="X.X"/> <input type="text" value="C"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                            |                                                  |                                 |                                                                 |                                        |                                          |                                               |                                                                  |                   |                                                                  |                                               |                                                                  |                                            |                                                                  |                   |                                                                     |                                                  |                                              |
| Mean Time Between Unscheduled Removals                                             | <input type="text" value="XXXXXX."/> HRS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                            |                                                  |                                 |                                                                 |                                        |                                          |                                               |                                                                  |                   |                                                                  |                                               |                                                                  |                                            |                                                                  |                   |                                                                     |                                                  |                                              |
| Schedule Maintenance Inspection Man Hours per                                      | <input type="text" value="X.XX"/> <input type="text" value="C"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                                                  |                                 |                                                                 |                                        |                                          |                                               |                                                                  |                   |                                                                  |                                               |                                                                  |                                            |                                                                  |                   |                                                                     |                                                  |                                              |
| 1000 Flight Hours                                                                  | <input type="text" value="X.XX"/> <input type="text" value="C"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                                                  |                                 |                                                                 |                                        |                                          |                                               |                                                                  |                   |                                                                  |                                               |                                                                  |                                            |                                                                  |                   |                                                                     |                                                  |                                              |
| Rectification Man Hours per 1000 Flight Hours                                      | <input type="text" value="X.XX"/> <input type="text" value="C"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                                                  |                                 |                                                                 |                                        |                                          |                                               |                                                                  |                   |                                                                  |                                               |                                                                  |                                            |                                                                  |                   |                                                                     |                                                  |                                              |
| Scheduled Maintenance Material Dollars per                                         | <input type="text" value="X.XX"/> <input type="text" value="C"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                                                  |                                 |                                                                 |                                        |                                          |                                               |                                                                  |                   |                                                                  |                                               |                                                                  |                                            |                                                                  |                   |                                                                     |                                                  |                                              |
| 1000 Flight Hours                                                                  | <input type="text" value="HRS^ -1"/> <input type="text" value="C"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                            |                                                  |                                 |                                                                 |                                        |                                          |                                               |                                                                  |                   |                                                                  |                                               |                                                                  |                                            |                                                                  |                   |                                                                     |                                                  |                                              |
| <input type="text" value="XXXXXXXXXX."/> DOLLARS                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                            |                                                  |                                 |                                                                 |                                        |                                          |                                               |                                                                  |                   |                                                                  |                                               |                                                                  |                                            |                                                                  |                   |                                                                     |                                                  |                                              |
| <input type="text" value="XXXXXX."/> DOLLARS                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                            |                                                  |                                 |                                                                 |                                        |                                          |                                               |                                                                  |                   |                                                                  |                                               |                                                                  |                                            |                                                                  |                   |                                                                     |                                                  |                                              |

FIG. 42

ASSET EPGDS Method

Schedule Interruption Costs

|                                                      |            |              |
|------------------------------------------------------|------------|--------------|
| Average Delay Cost per Delay Hour                    | XXXXXX.    | DOLLARS/HOUR |
| Average Cancellation Cost per Cancellation           | XXXXXX.    | DOLLARS      |
| Average Air Turnback Cost per Turnback               | XXXXXX.    | DOLLARS      |
| Average Diversion Cost per Diversion                 | XXXXXX.    | DOLLARS      |
| Number of Delays per 100 Departures                  | X.XXXX     | HRS          |
| Average Delay Time (Hours)                           | X.XX       |              |
| Number of Cancellations per 100 Departures           | X.XXXX     |              |
| Number of Air Turnbacks per 100 Departures           | X.XXXX     |              |
| Number of Diversions per 100 Departures              | X.XXXX     |              |
| Schedule Interruptions Cost (NPV of Life Cycle Cost) | XXXXXXXXX. | DOLLARS      |
| Schedule Interruptions Cost per Airplane per Year    | XXXXX.     | DOLLARS      |

ASSET EPGDS Method

Dependability Cost Summary

83a      NPV of Life Cycle Cost      Per Airplane per Year 83b

|                             |   |         |
|-----------------------------|---|---------|
| Line Maintenance Cost       | ◊ | XXXXX.  |
| Shop Maintenance Cost       | ◊ | XXXXXX. |
| Scheduled Maintenance Cost  | ◊ | XXXXXX. |
| Schedule Interruptions Cost | ◊ | XXXXXX. |
| Spares Cost                 | ◊ | XXXXXX. |
| Fuel Cost                   | ◊ | XXXXXX. |

Dependability Cost      83

|          |   |         |
|----------|---|---------|
| XXXXXXX. | ◊ | XXXXXX. |

asset

File Run Goto Report

Help

FIG. 44

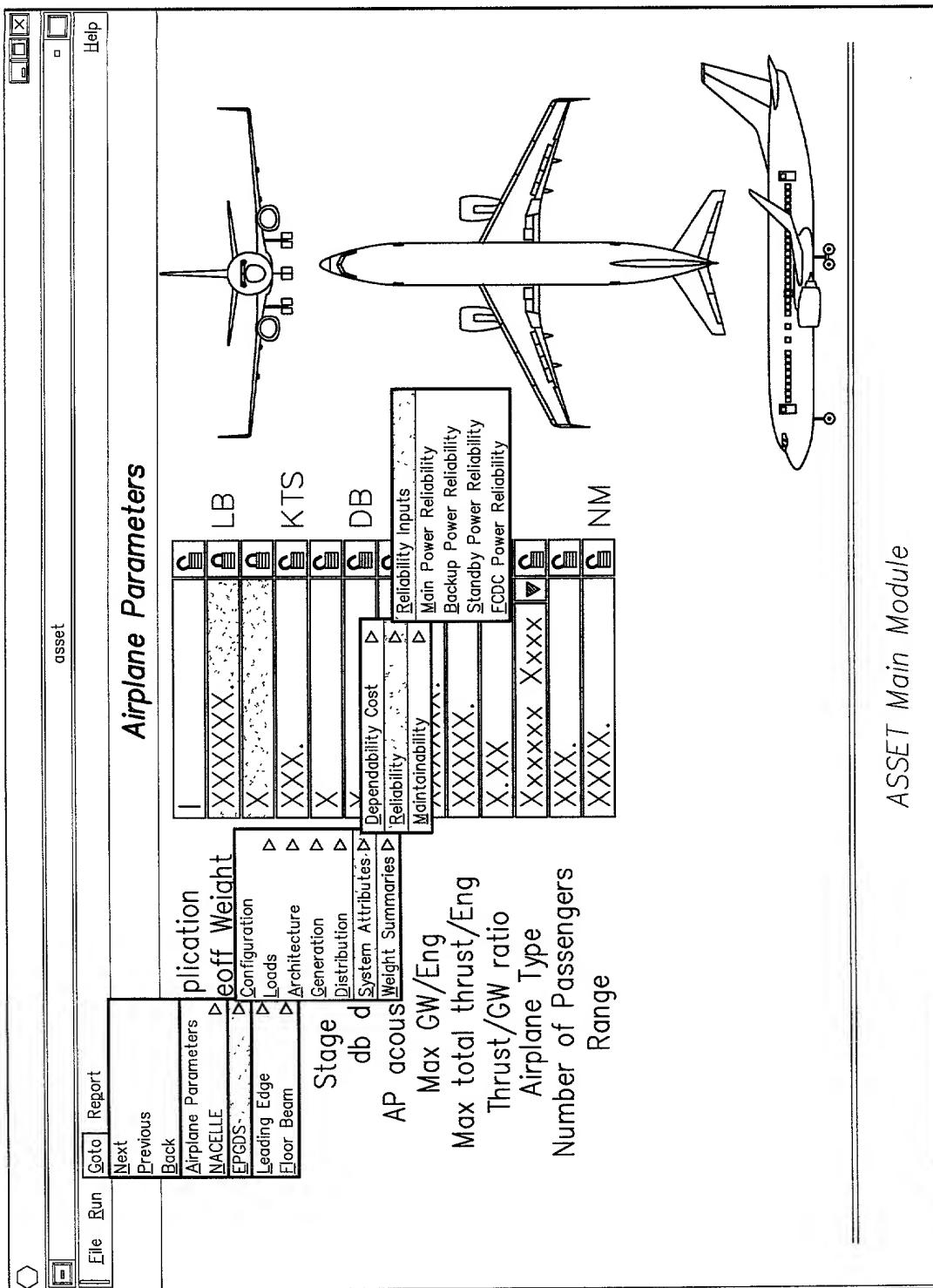
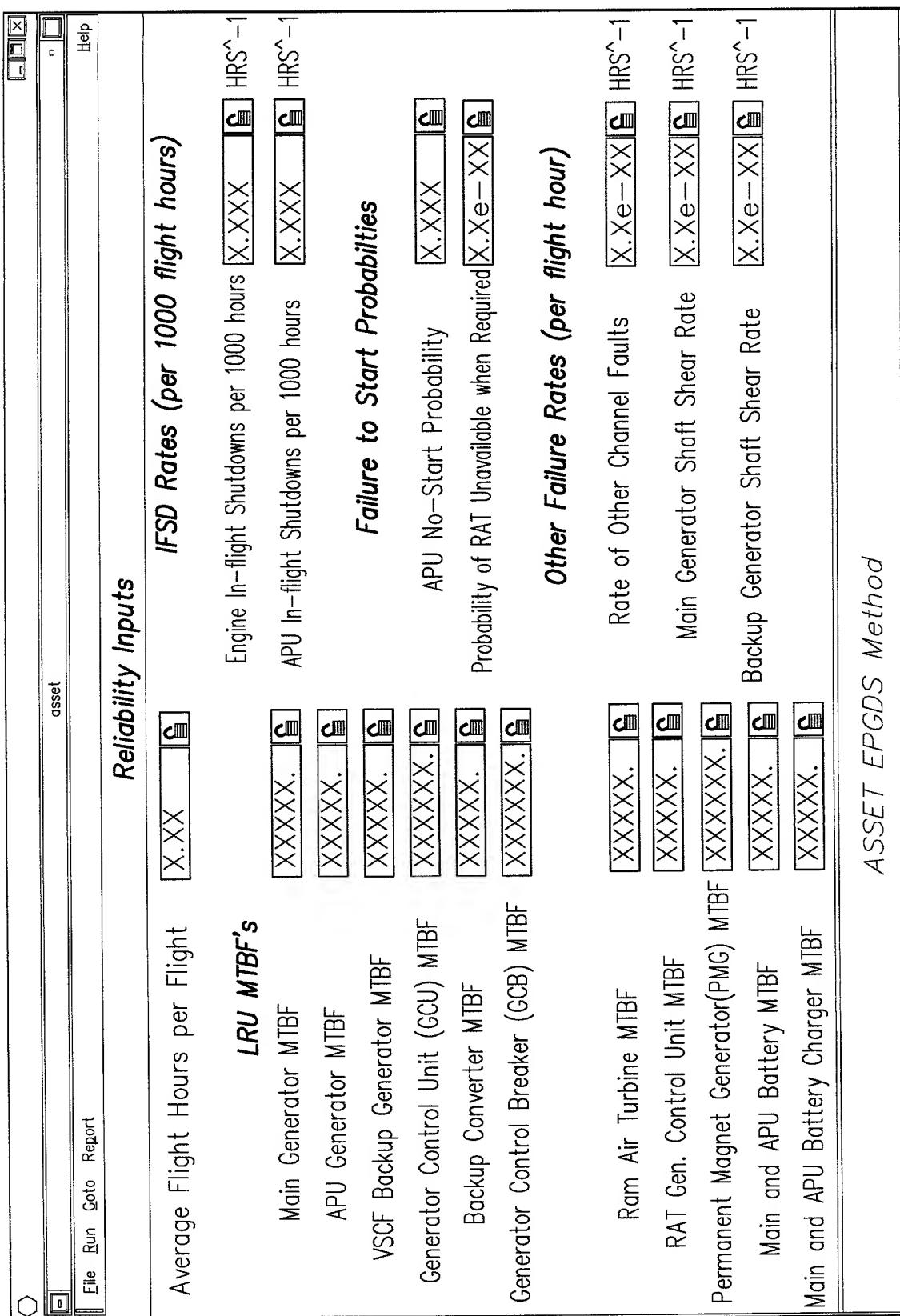


FIG. 45



The screenshot shows the ASSET EPADS software interface with the following window elements:

- Top Bar:** Includes icons for file operations (New, Open, Save, Print, Exit), a search bar, and a help icon.
- Left Sidebar:** Buttons for "asset", "File", "Run", "Goto", and "Report".
- Table:** The "Reliability Inputs" table is displayed with the following data:

| Reliability Inputs                           |           | IFSD Rates (per 1000 flight hours)           |            |
|----------------------------------------------|-----------|----------------------------------------------|------------|
| Average Flight Hours per Flight              | [X.XX]    | Engine In-flight Shutdowns per 1000 hours    | [X.XXXX]   |
| <b>LRU MTBF's</b>                            |           | APU In-flight Shutdowns per 1000 hours       | [X.XXXX]   |
| Main Generator MTBF                          | [XXXXXX.] | APU No-Start Probability                     | [X.XXXX]   |
| APU Generator MTBF                           | [XXXXXX.] | Probability of RAT Unavailable when Required | [X.Xe-XX]  |
| VSCF Backup Generator MTBF                   | [XXXXXX.] | <b>Failure to Start Probabilities</b>        |            |
| Generator Control Unit (GCU) MTBF            | [XXXXXX.] | Rate of Other Channel Faults                 | [X.Xe-XXX] |
| Backup Converter MTBF                        | [XXXXXX.] | Main Generator Shaft Shear Rate              | [X.Xe-XX]  |
| Generator Control Breaker (GCB) MTBF         | [XXXXXX.] | Backup Generator Shaft Shear Rate            | [X.Xe-XX]  |
| <b>Other Failure Rates (per flight hour)</b> |           |                                              |            |
| Ram Air Turbine MTBF                         | [XXXXXX.] | ASSET EPADS Method                           |            |
| RAT Gen. Control Unit MTBF                   | [XXXXXX.] |                                              |            |
| Permanent Magnet Generator(PMG) MTBF         | [XXXXXX.] |                                              |            |
| Main and APU Battery MTBF                    | [XXXXXX.] |                                              |            |
| Main and APU Battery Charger MTBF            | [XXXXXX.] |                                              |            |

FIG. 46

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

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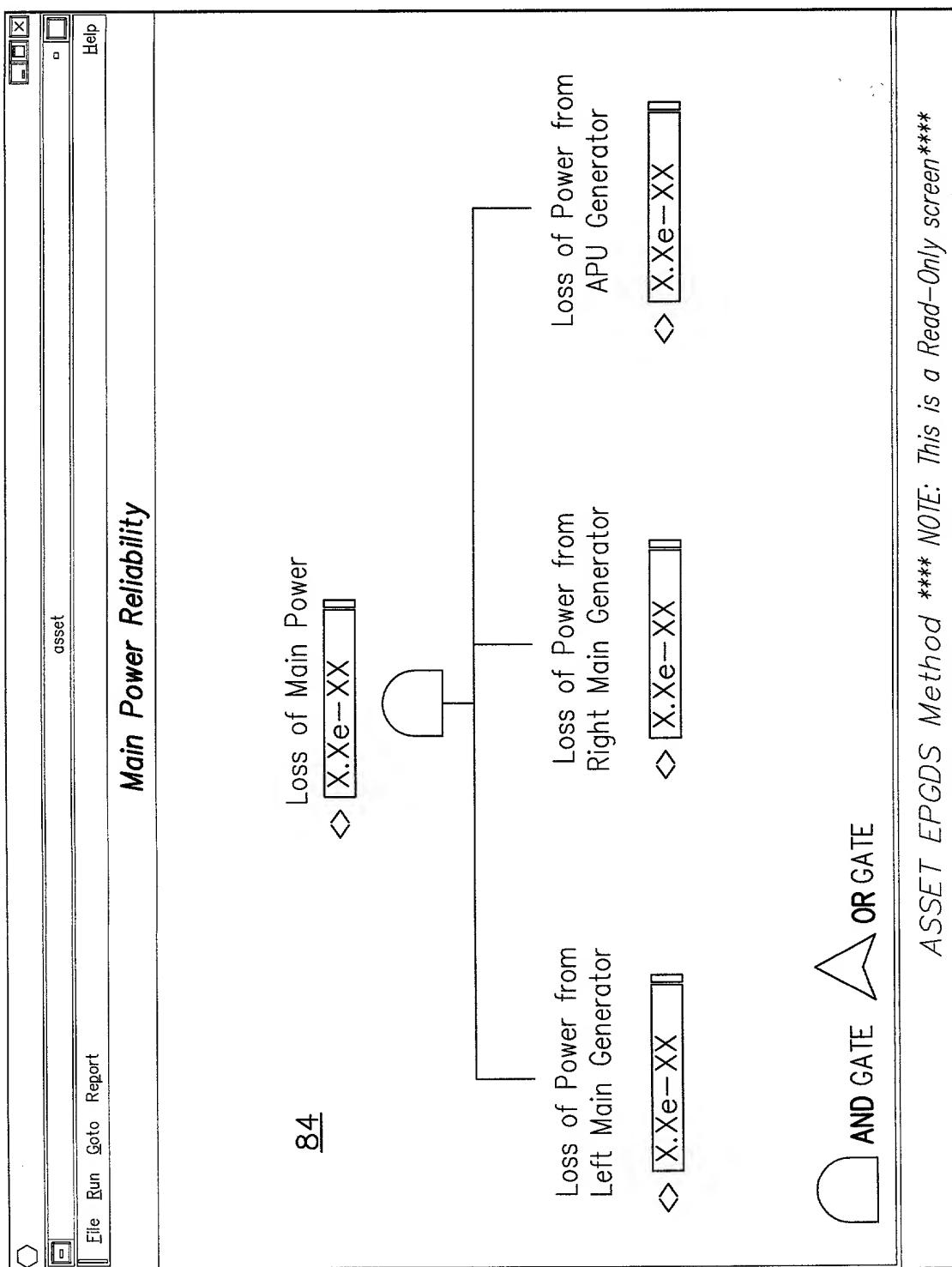


FIG. 47

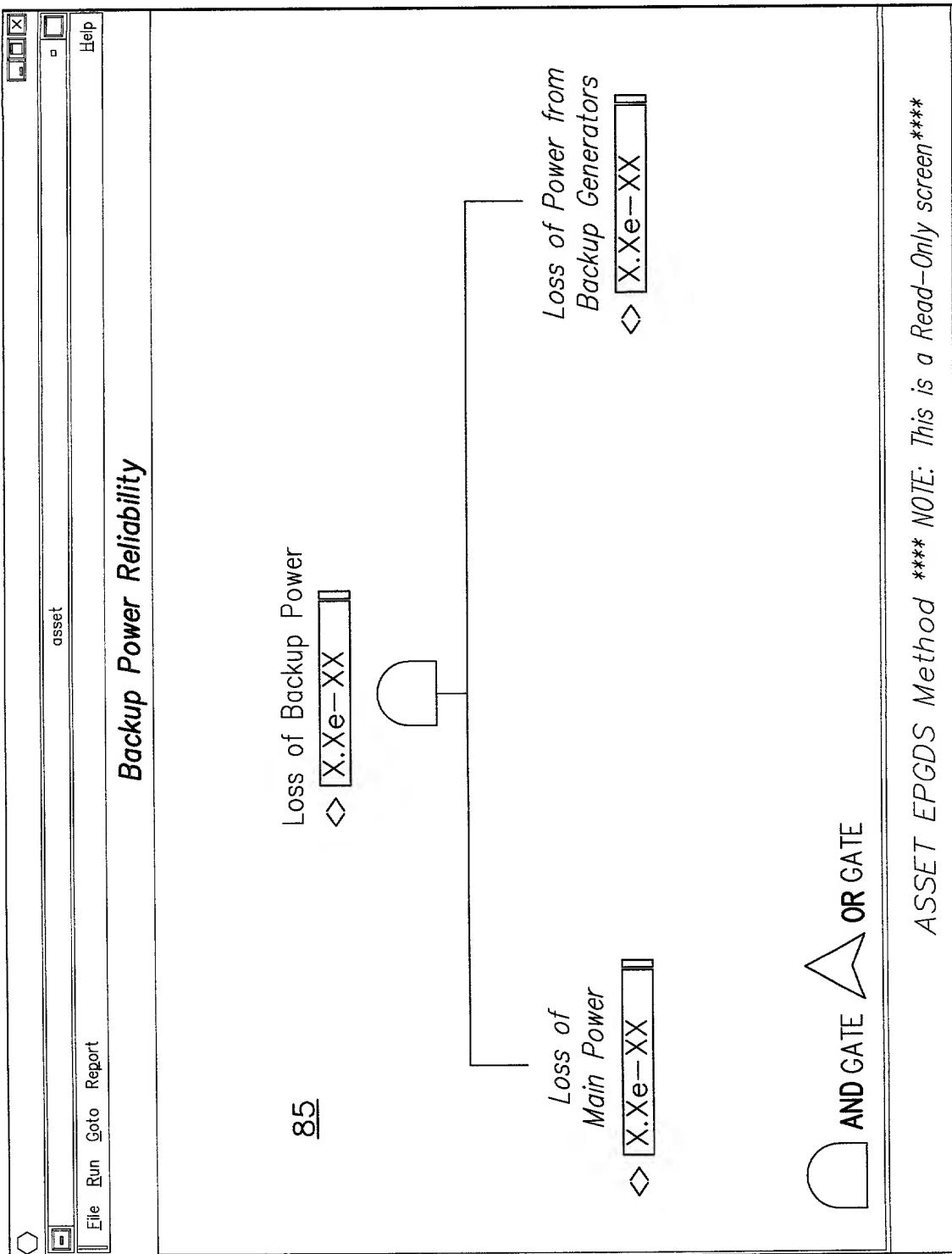
TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

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FIG.

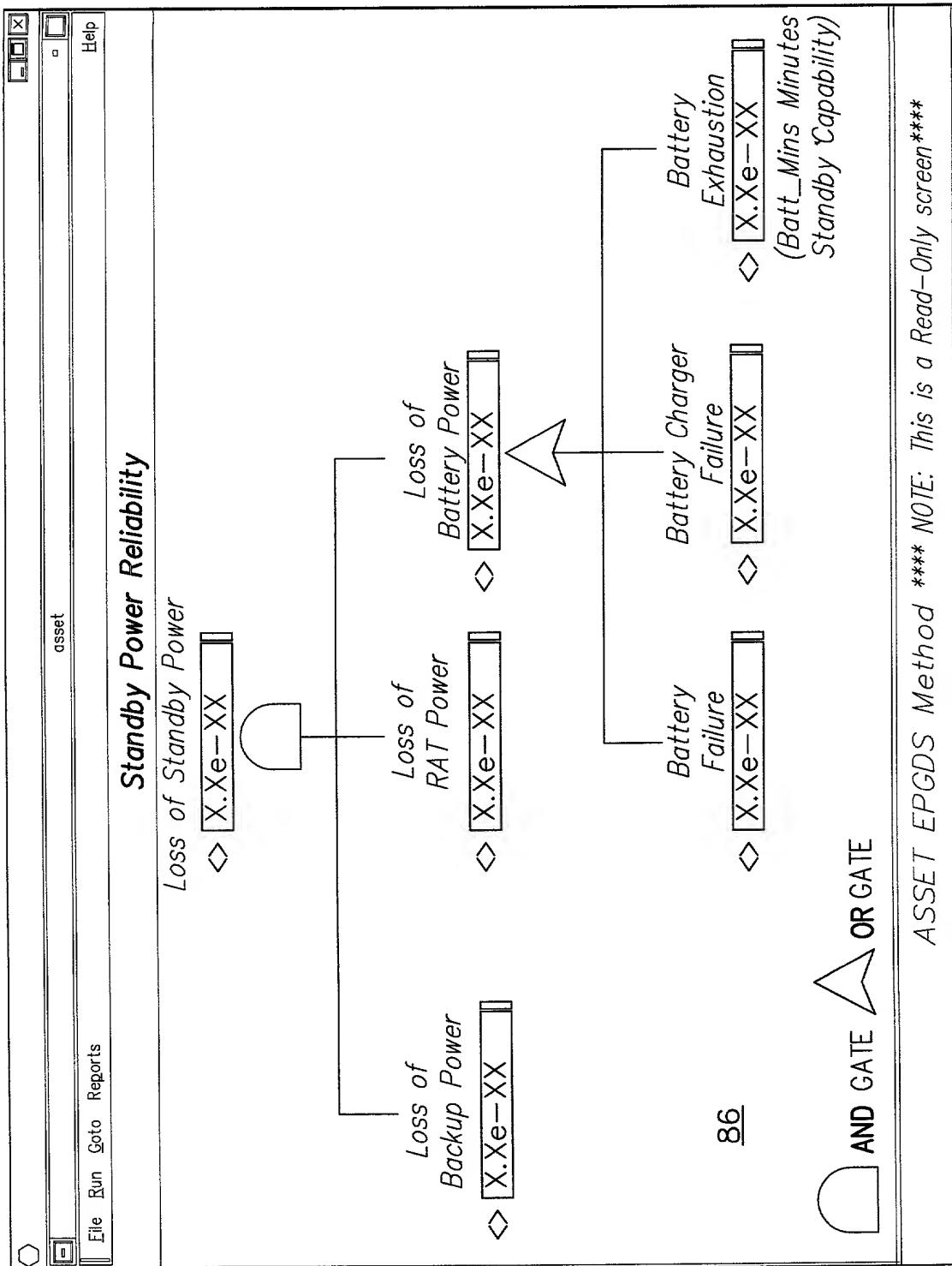


FIG. 49

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

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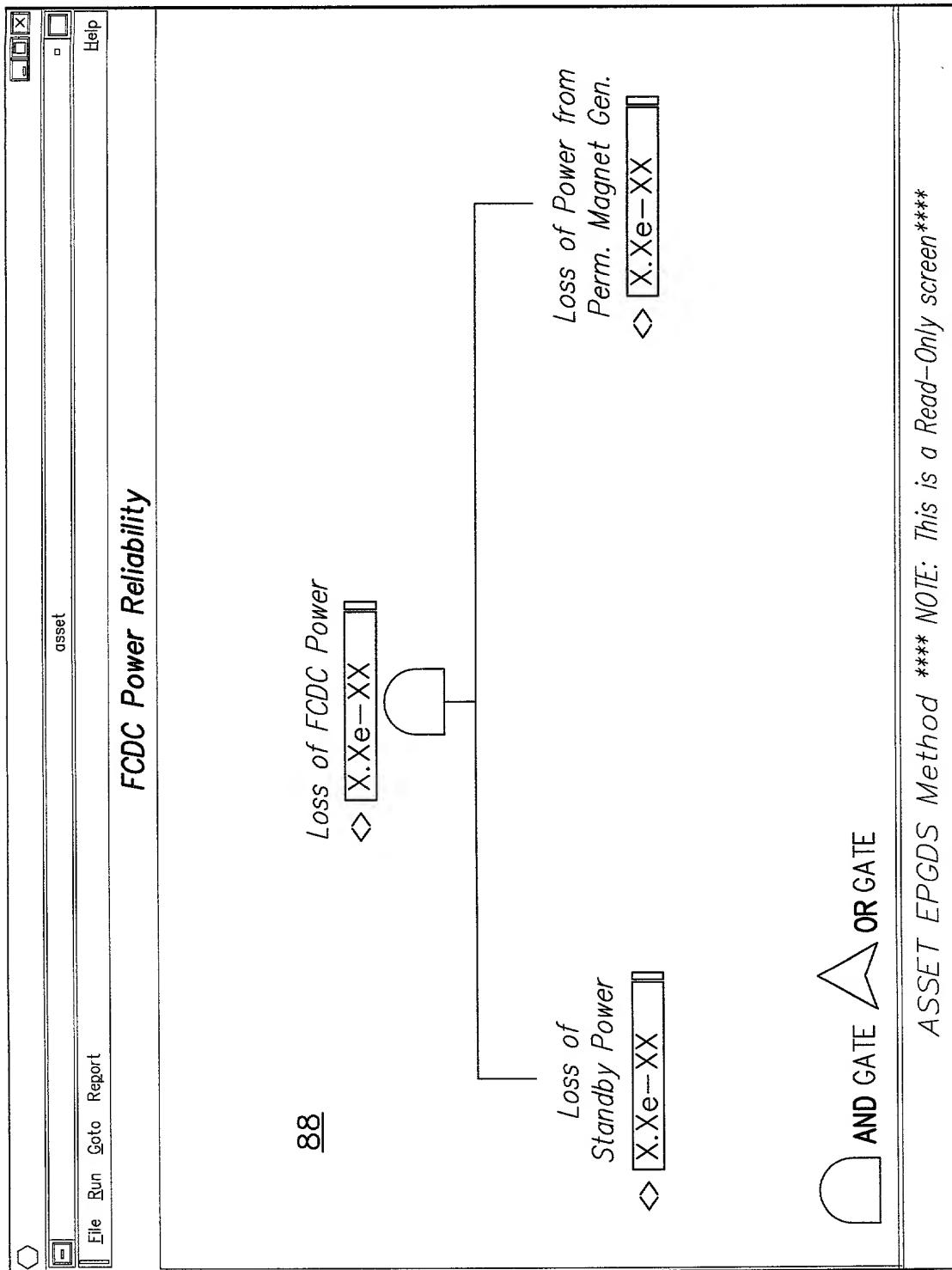


FIG. 50

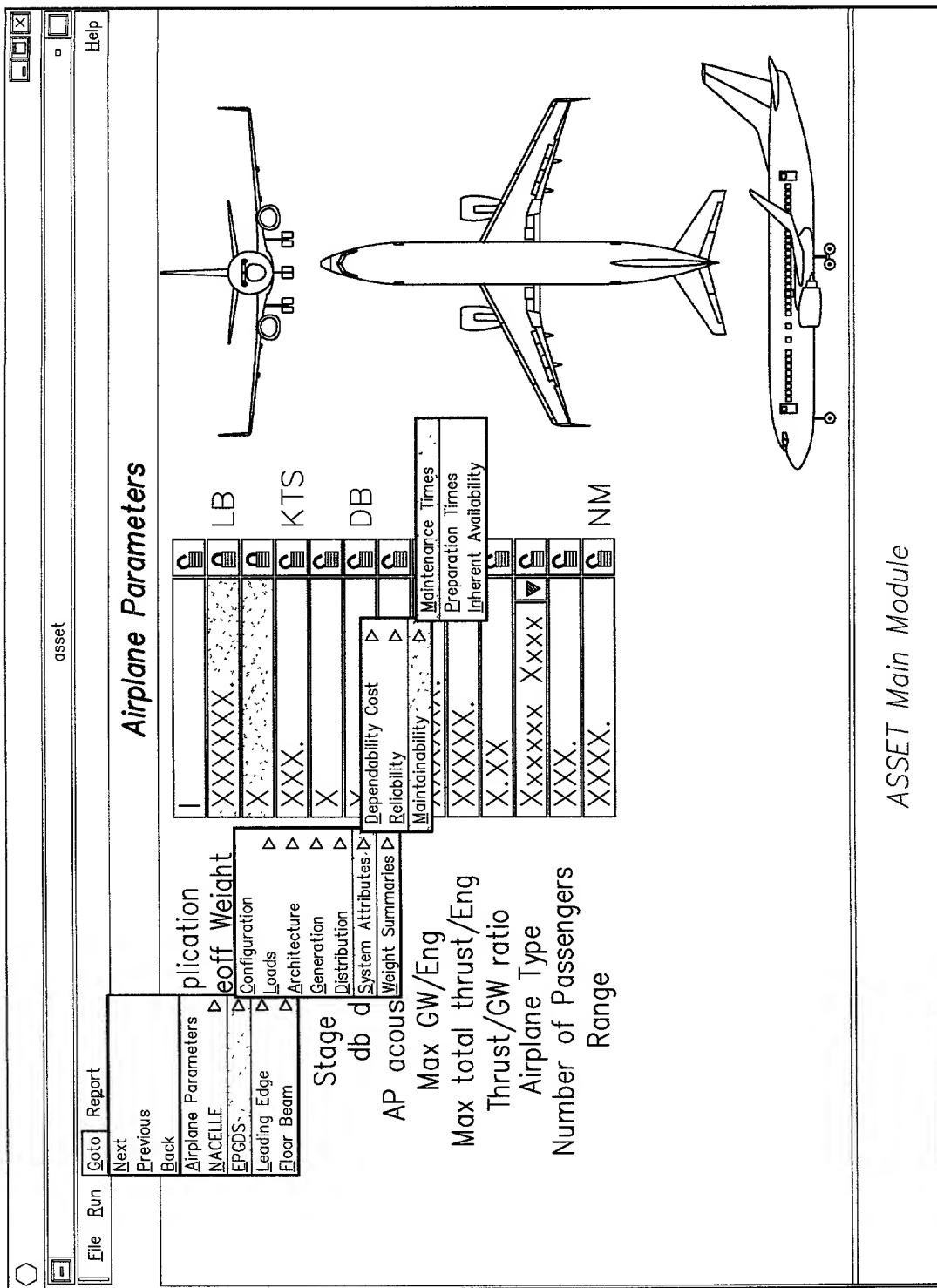
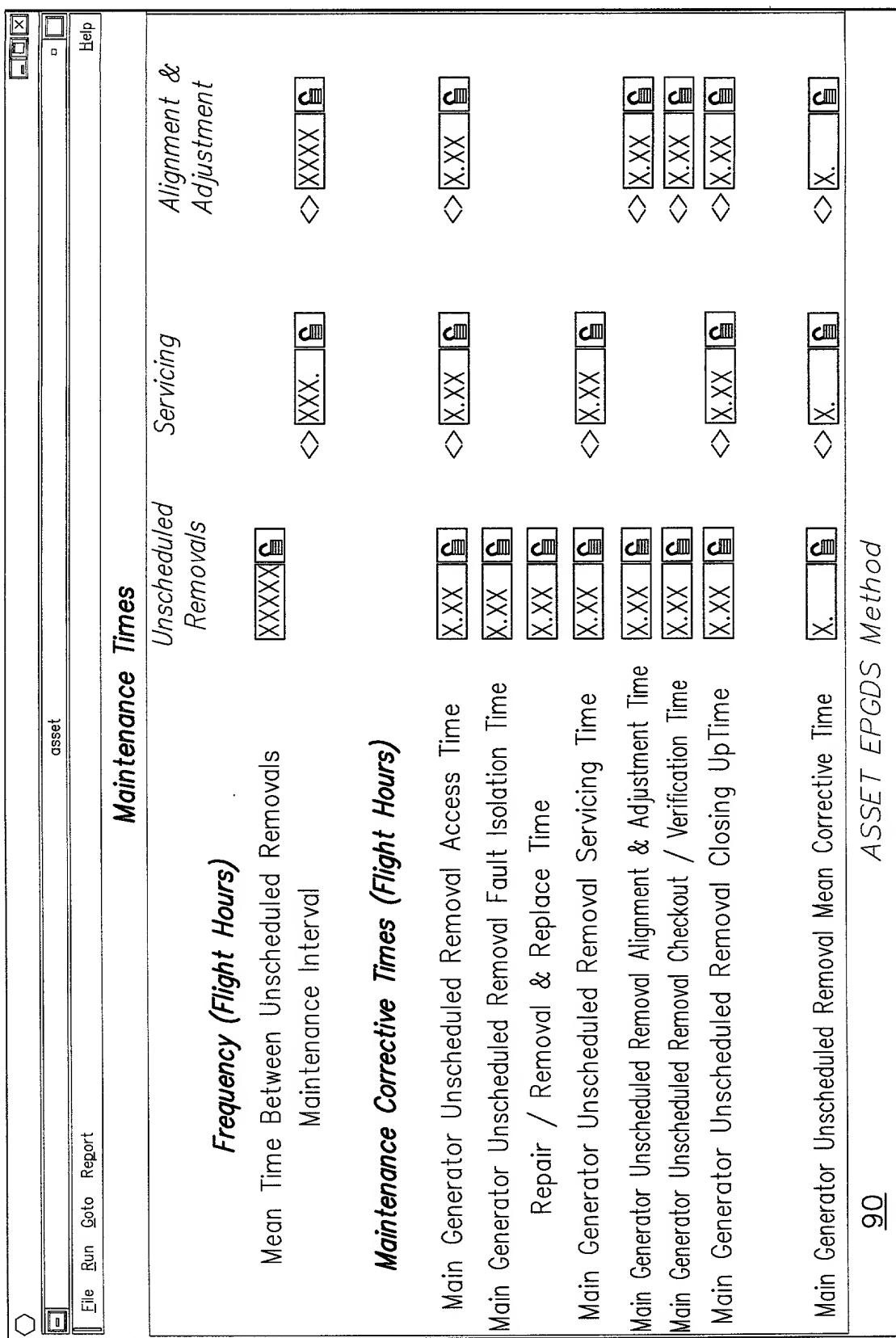


FIG. 51



The screenshot shows a software interface for 'ASSET EPGDS Method'. The menu bar includes 'File', 'Run', 'Goto', 'Report', 'Help', and a window title 'asset'. The main window displays maintenance times for a 'Main Generator'.

**Maintenance Times**

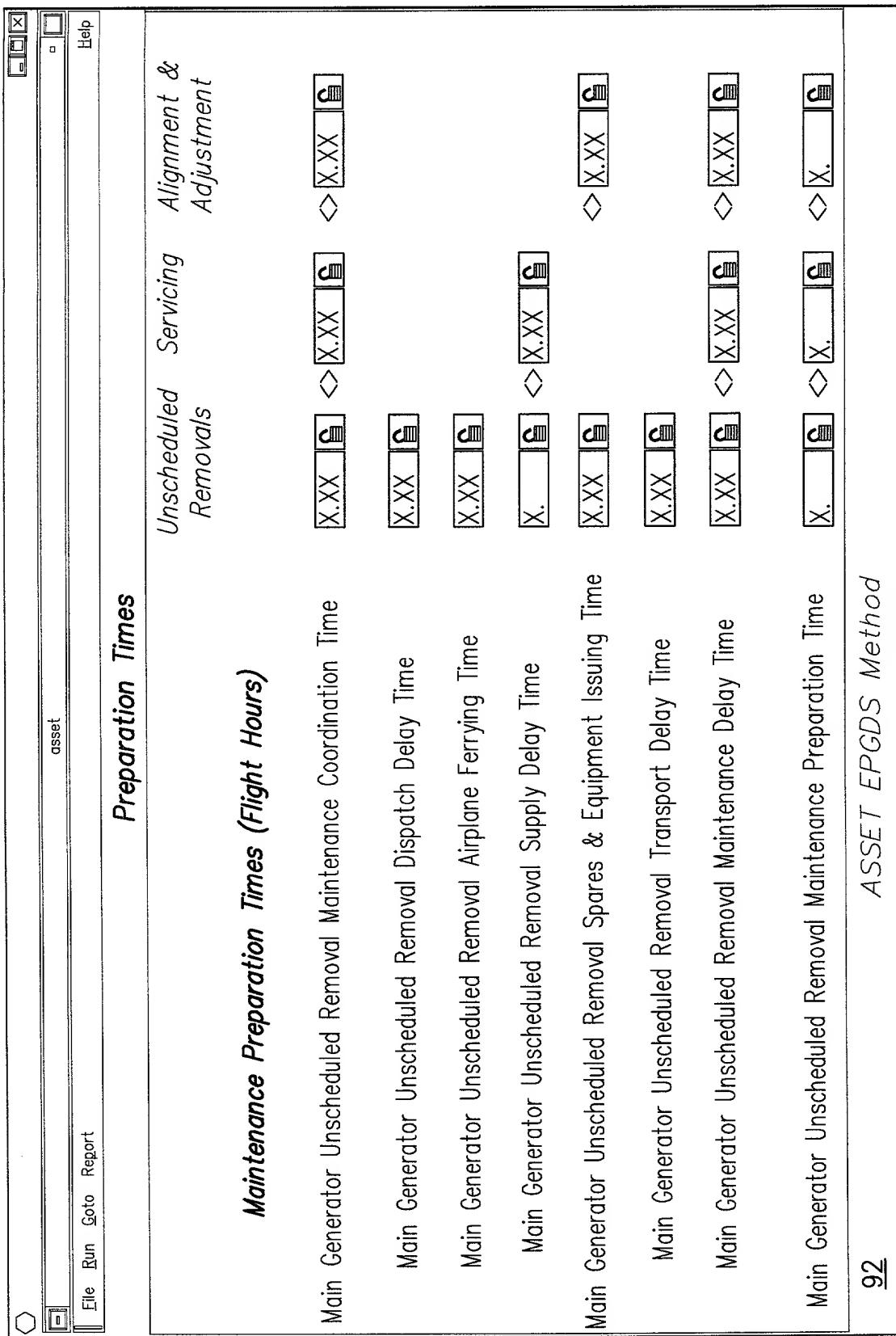
| <i>Frequency (Flight Hours)</i>        | <i>Unscheduled Removals</i> | <i>Servicing</i> | <i>Alignment &amp; Adjustment</i> |
|----------------------------------------|-----------------------------|------------------|-----------------------------------|
| Mean Time Between Unscheduled Removals | XXXXX [File]                | ◇ XXX [File]     | ◇ XXXX [File]                     |
| Maintenance Interval                   |                             |                  |                                   |

**Maintenance Corrective Times (Flight Hours)**

|                                                                 |             |               |               |
|-----------------------------------------------------------------|-------------|---------------|---------------|
| Main Generator Unscheduled Removal Access Time                  | X.XX [File] | ◇ X.XX [File] | ◇ X.XX [File] |
| Main Generator Unscheduled Removal Fault Isolation Time         | X.XX [File] |               |               |
| Repair / Removal & Replace Time                                 | X.XX [File] |               |               |
| Main Generator Unscheduled Removal Servicing Time               | X.XX [File] | ◇ X.XX [File] | ◇ X.XX [File] |
| Main Generator Unscheduled Removal Alignment & Adjustment Time  | X.XX [File] |               |               |
| Main Generator Unscheduled Removal Checkout / Verification Time | X.XX [File] |               |               |
| Main Generator Unscheduled Removal Closing UpTime               | X.XX [File] | ◇ X.XX [File] | ◇ X.XX [File] |

ASSET EPGDS Method

FIG. 52



The screenshot shows a software interface for 'ASSET EPGDS Method'. The menu bar includes 'File', 'Run', 'Goto Report', and 'Help'. The main window has a title bar 'Preparation Times' and a sub-section 'Maintenance Preparation Times (Flight Hours)'. A table lists various maintenance tasks with their corresponding times and checkboxes for 'Unscheduled Removals', 'Servicing', and 'Alignment & Adjustment'.

|                                                                    | Unscheduled Removals          | Servicing                        | Alignment & Adjustment           |
|--------------------------------------------------------------------|-------------------------------|----------------------------------|----------------------------------|
| Main Generator Unscheduled Removal Maintenance Coordination Time   | X.XX <input type="checkbox"/> | <> X.XX <input type="checkbox"/> | <> X.XX <input type="checkbox"/> |
| Main Generator Unscheduled Removal Dispatch Delay Time             | X.XX <input type="checkbox"/> |                                  |                                  |
| Main Generator Unscheduled Removal Airplane Ferrying Time          | X.XX <input type="checkbox"/> |                                  |                                  |
| Main Generator Unscheduled Removal Supply Delay Time               | X. <input type="checkbox"/>   | <> X.XX <input type="checkbox"/> | <> X.XX <input type="checkbox"/> |
| Main Generator Unscheduled Removal Spares & Equipment Issuing Time | X.XX <input type="checkbox"/> |                                  |                                  |
| Main Generator Unscheduled Removal Transport Delay Time            | X.XX <input type="checkbox"/> |                                  |                                  |
| Main Generator Unscheduled Removal Maintenance Delay Time          | X.XX <input type="checkbox"/> | <> X.XX <input type="checkbox"/> | <> X.XX <input type="checkbox"/> |
| Main Generator Unscheduled Removal Maintenance Preparation Time    | X. <input type="checkbox"/>   | <> X. <input type="checkbox"/>   | <> X. <input type="checkbox"/>   |

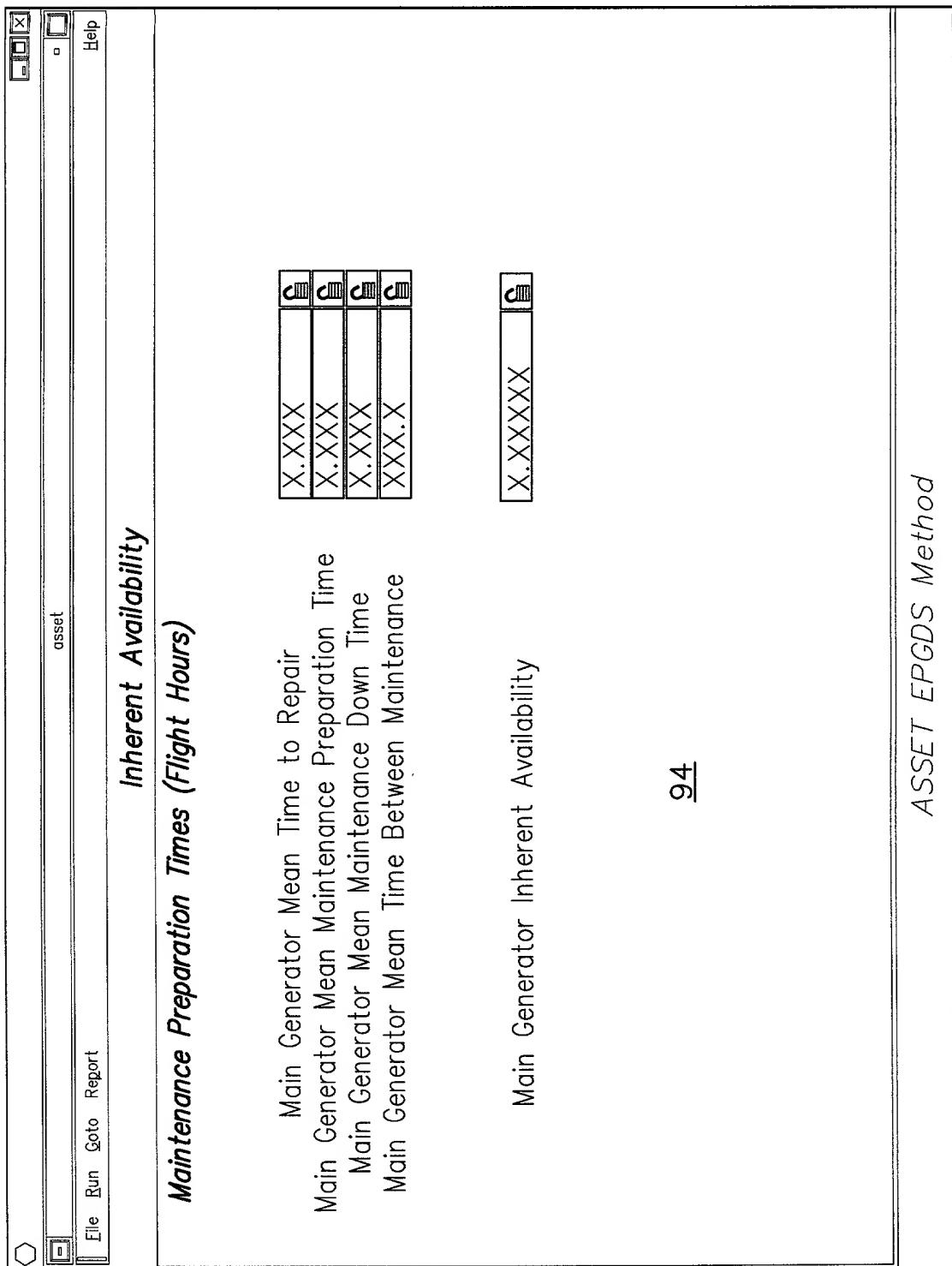


FIG. 54

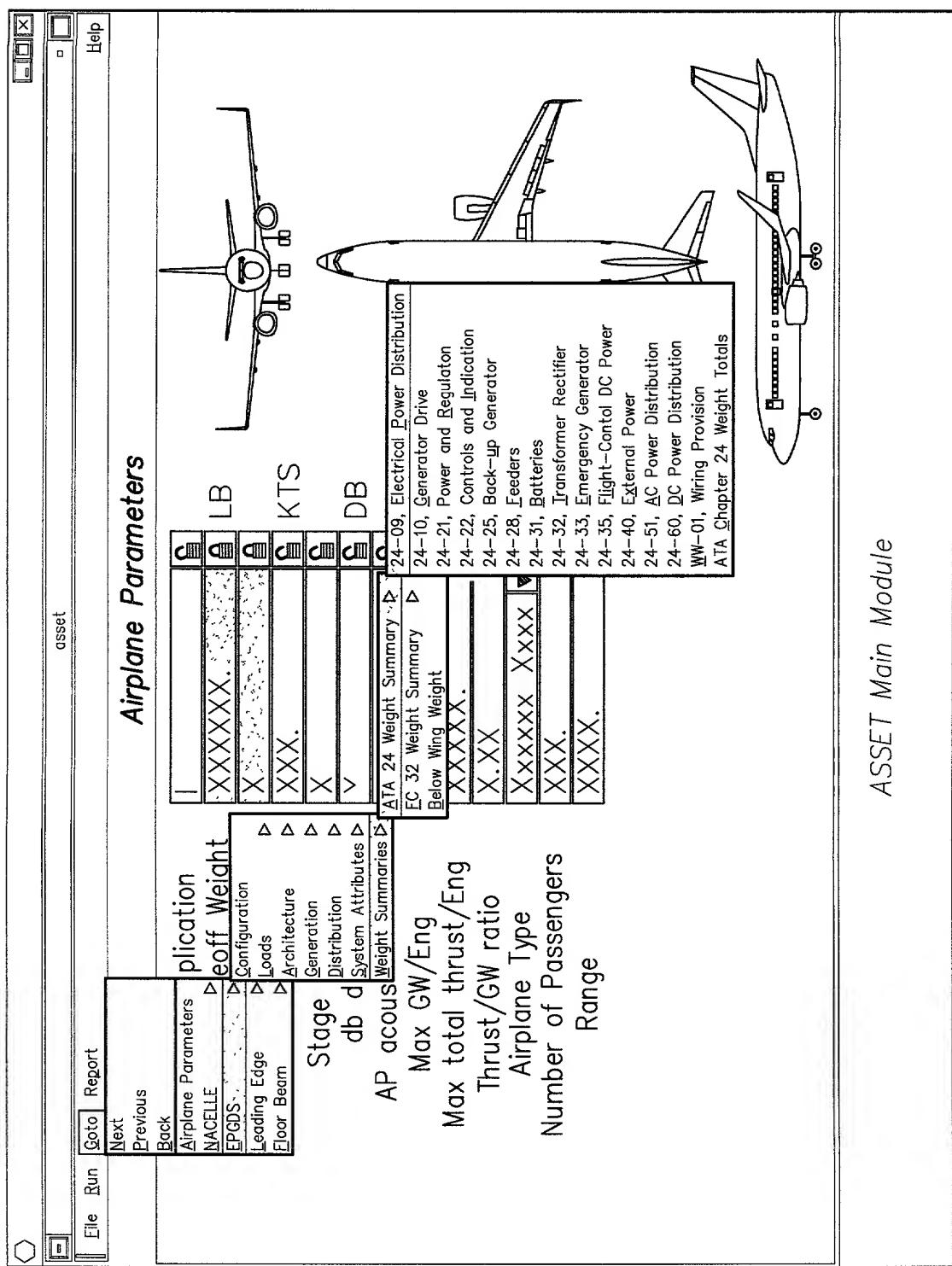


FIG. 55

FIG. 56

FIG. 57

58

FIG. 59

FIG. 60

FIG. 61

FIG. 62

FIG. 63

FIG. 64

FIG. 65

FIG. 66

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FIG. 67

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FIG. 68

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FIG. 69

The screenshot shows a software interface for 'ASSET EP GDS Method'. The menu bar includes 'File', 'Run', 'Goto', 'Report', and 'Help'. The toolbar includes icons for 'New', 'Open', 'Save', 'Print', and 'Exit'. A left sidebar has a 'asset' icon and a 'Help' icon. The main window title is 'ATA Chapter 24 Weight Totals'. The table lists ATA chapters and their sub-components with their respective weights:

|                                          |        |    |
|------------------------------------------|--------|----|
| ATA 24-09, Electrical Power Distribution | XXXX.X | LB |
| ATA 24-10, Generator Drive               | XXXX.X | LB |
| ATA 24-21, Power and Regulation          | XXXX.X | LB |
| ATA 24-22, Controls and Indication       | XXXX.X | LB |
| ATA 24-25, Back-up Generators            | XXXX.X | LB |
| ATA 24-28, Feeders                       | XXXX.X | LB |
| ATA 24-31, Batteries                     | XXXX.X | LB |
| ATA 24-32, Transformer Rectifier         | XXX.X  | LB |
| ATA 24-33, Emergency Generator           | XXXX.X | LB |
| ATA 24-35, Flight-Control DC Power       | XXXX.X | LB |
| ATA 24-40, External Power                | XXX.X  | LB |
| ATA 24-51, AC Power Distribution         | XXXX.X | LB |
| ATA 24-60, DC Power Distribution         | XXX.X  | LB |
| WW-01, Wiring Provision                  | XXXX.X | LB |

Electrical Power Generation & Distribution System    XXXXX.X    LB

ASSET EP GDS Method

FIG. 70

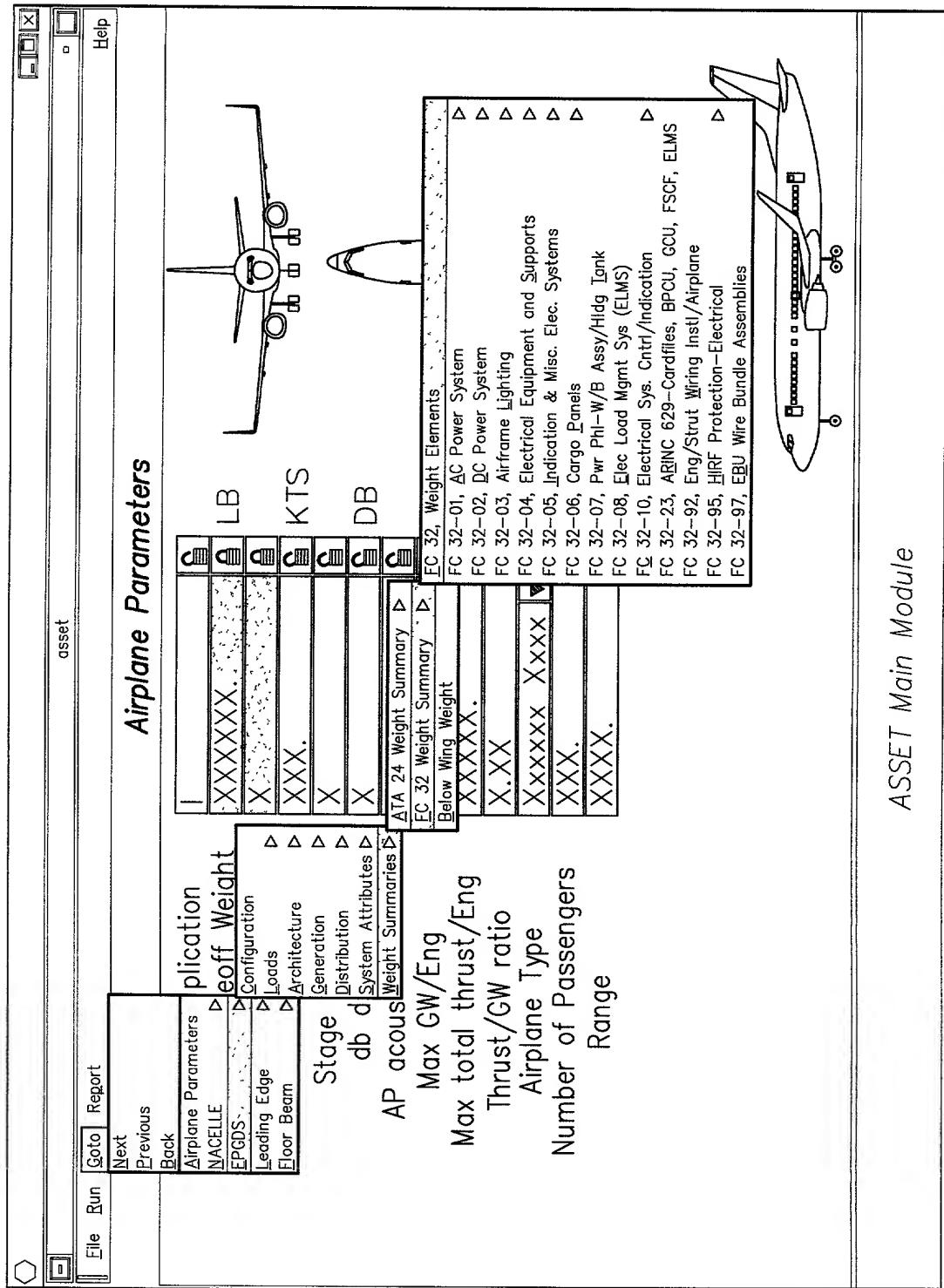


FIG. 71

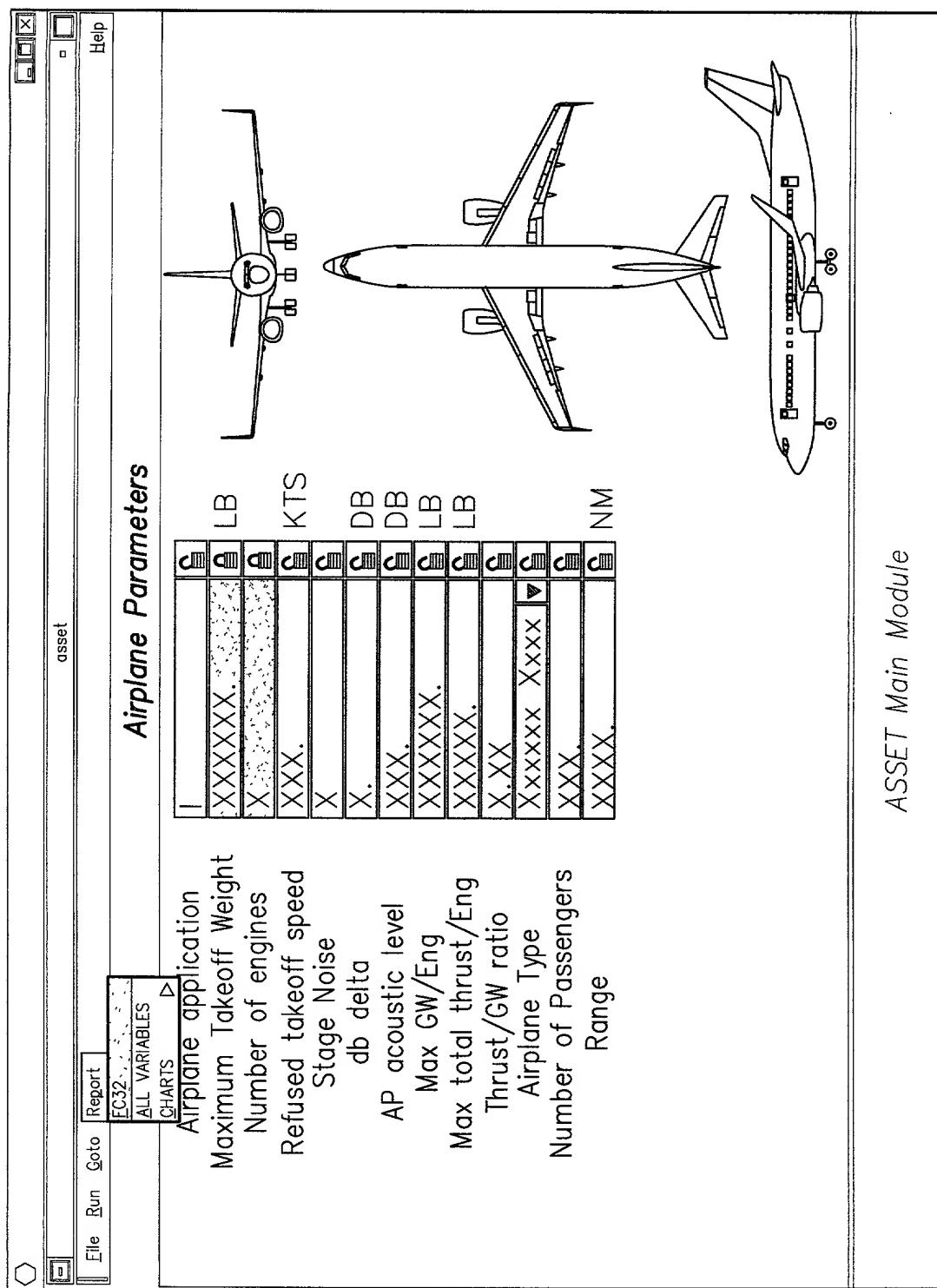


FIG. 72

ASSET

File Run Goto Report Help

Airplane application  ASSET: Report

Airplane Parameters

Maximum Takeoff Weight  LB

Component # Component Designation Qty Unit Wt (LB)

| Electrical Power Generation & Distribution System |                   |                                    |        |
|---------------------------------------------------|-------------------|------------------------------------|--------|
| 32                                                | 32-01             | AC Power System                    | XXXX.X |
| 32-01-01                                          | 32-01-01-01       | AC POWER GENERATION EQUIPMENT      | XXXX.X |
| 32-01-01-01-01                                    | 32-01-01-01-01-01 | MAIN AC POWER GENERATORS INSTLD    | XXXX.X |
| 32-01-01-01-02                                    | 32-01-01-01-02    | PRIME DRIVE GENERATOR              | XXXX.X |
| 32-01-01-01-03                                    | 32-01-01-01-03    | QUICK ATTACH DETACH (QAD)          | XXXX.X |
| 32-01-01-01-04                                    | 32-01-01-01-04    | GENERATOR FLUIDS                   | XXXX.X |
| 32-01-01-01-05                                    | 32-01-01-01-05    | HARDWARE INSTALLATION              | XXXX.X |
| 32-01-01-01-06                                    | 32-01-01-01-06    | WIRING INSTALLATION                | XXXX.X |
| 32-01-01-01-07                                    | 32-01-01-01-07    | GENERATOR CONTROL UNITS            | XXXX.X |
| 32-01-01-01-08                                    | 32-01-01-01-08    | BUS POWER CONTROL UNITS            | XXXX.X |
| 32-01-01-01-09                                    | 32-01-01-01-09    | EROPS-VSCF POWER GENERATION SYSTEM | XXXX.X |
| 32-01-05-01                                       | 32-01-05-01       | VSCF GENERATORS & OIL              | XXXX.X |
| 32-01-05-01-01                                    | 32-01-05-01-01    | VSCF GENERATOR                     | XXXX.X |
| 32-01-05-01-02                                    | 32-01-05-01-02    | VSCF GENERATOR OIL                 | XXXX.X |

Return

send to printer

save to file

ASSET Main Module

**Airplane Parameters**

|                           |                                               |  |
|---------------------------|-----------------------------------------------|--|
| Airplane application      | <input type="text" value="XXXXXXX."/>         |  |
| Maximum Takeoff Weight    | <input type="text" value="LB"/>               |  |
| ASSET: Report             |                                               |  |
| AC_Stndby_Load            | AC Standby Load                               |  |
| AGen_MTBF                 | APU Generator MTBF                            |  |
| APA                       | Airplane application                          |  |
| APUG_Cap                  | APU Generator Capacity                        |  |
| APUG_Cap_As_Built         | APU Generator Capacity                        |  |
| APUG_Wt                   | APU Generator Weight                          |  |
| APU_Batt_Cap              | Nominal Capacity                              |  |
| APU_Batt_Chgr_Cap         | Output Capacity                               |  |
| APU_Batt_Chgr_Wt          | Battery Charger Weight                        |  |
| APU_Batt_Chgr_Wt_As_Built | Battery Charger Weight                        |  |
| APU_Batt_Wt               | Battery Weight                                |  |
| APU_Batt_Wt_As_Built      | Battery Weight                                |  |
| APU_Ch_Prob               | Probability of Lost of APU Generating Channel |  |
| APU_Feeder                | APU Feeder Configuration                      |  |
| APU_GCU_Size              | APU Generator GCU Size                        |  |
| APU_GCU_Wt                | Unit Weight                                   |  |

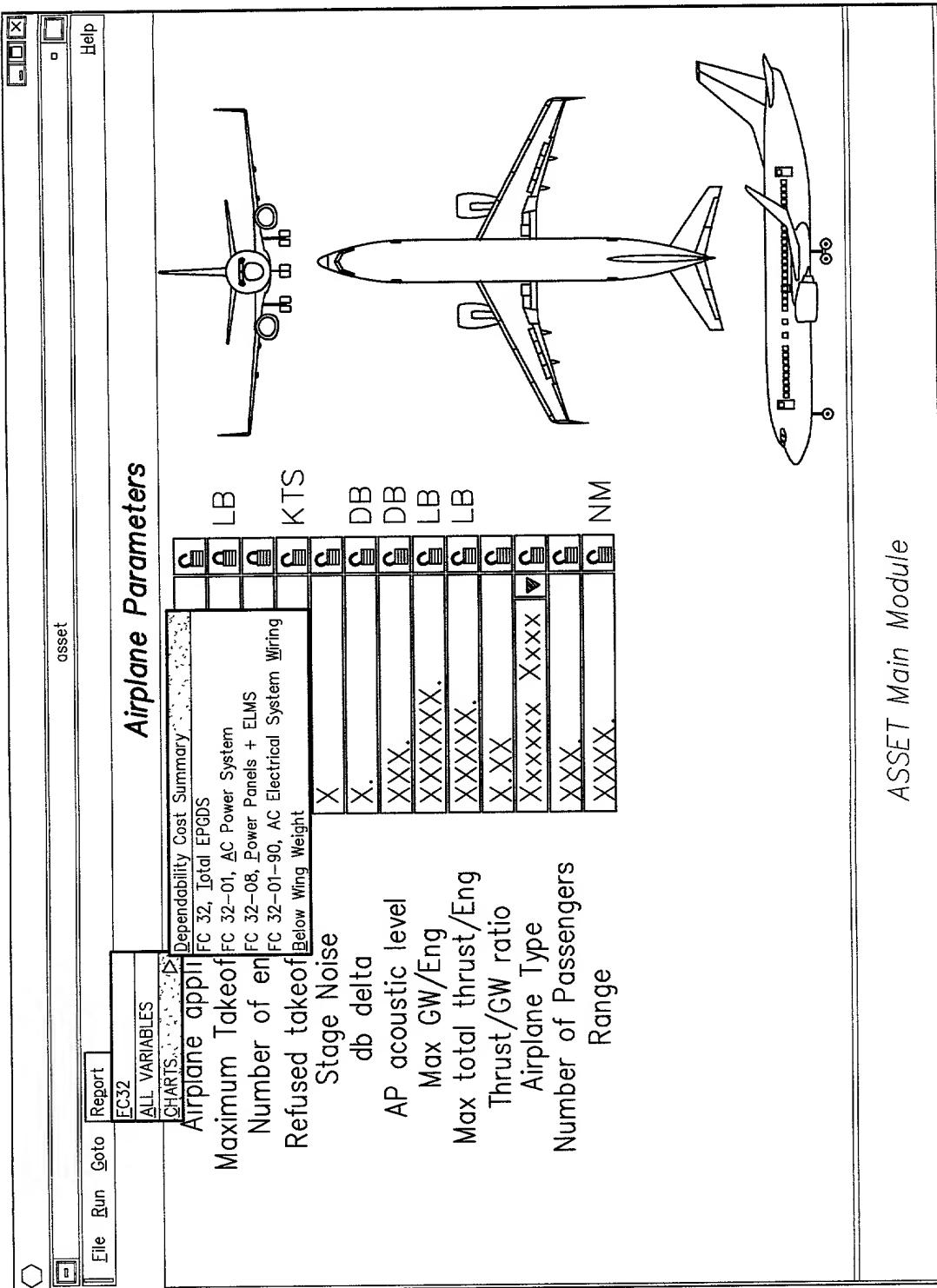


FIG. 75

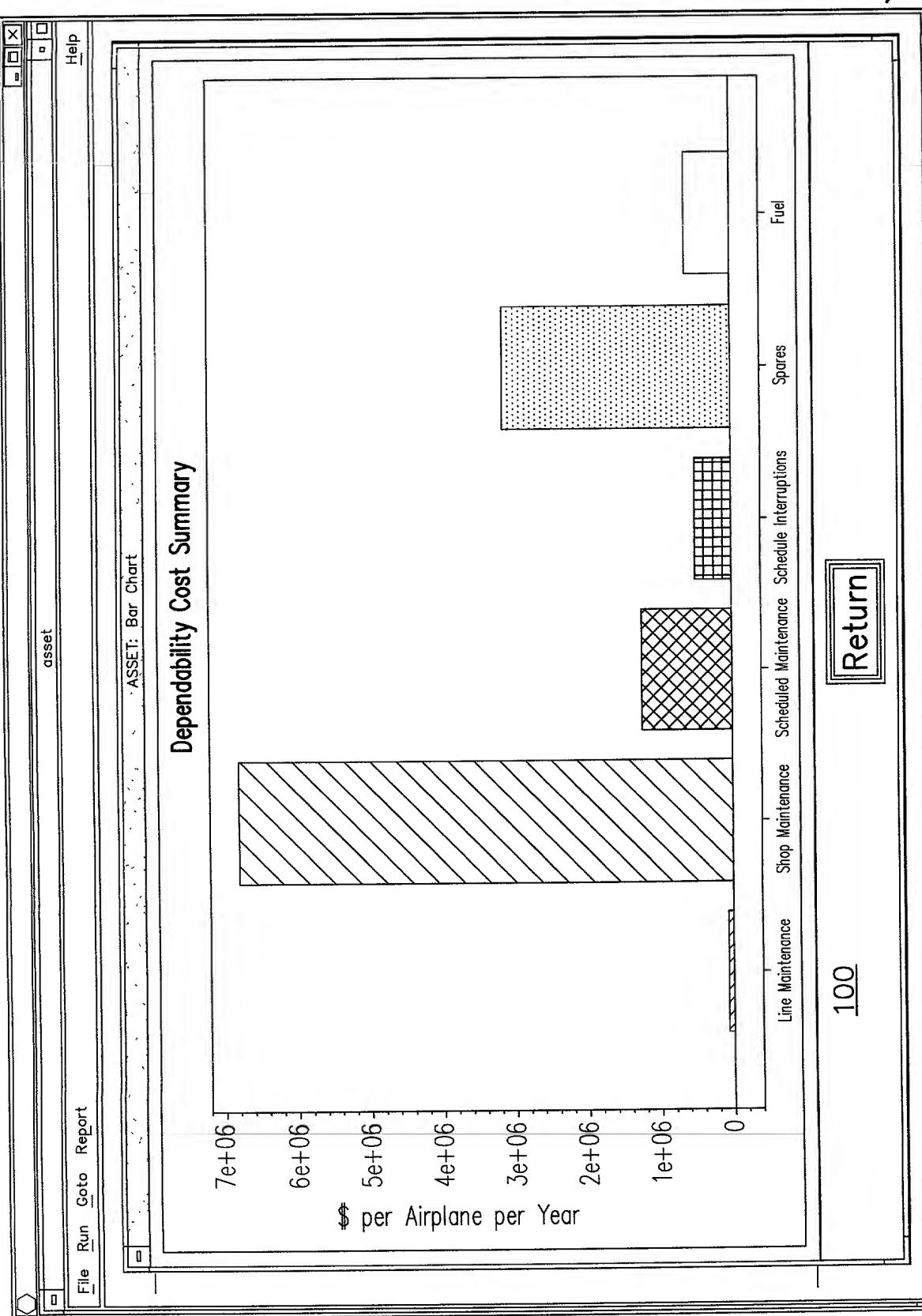


FIG. 76

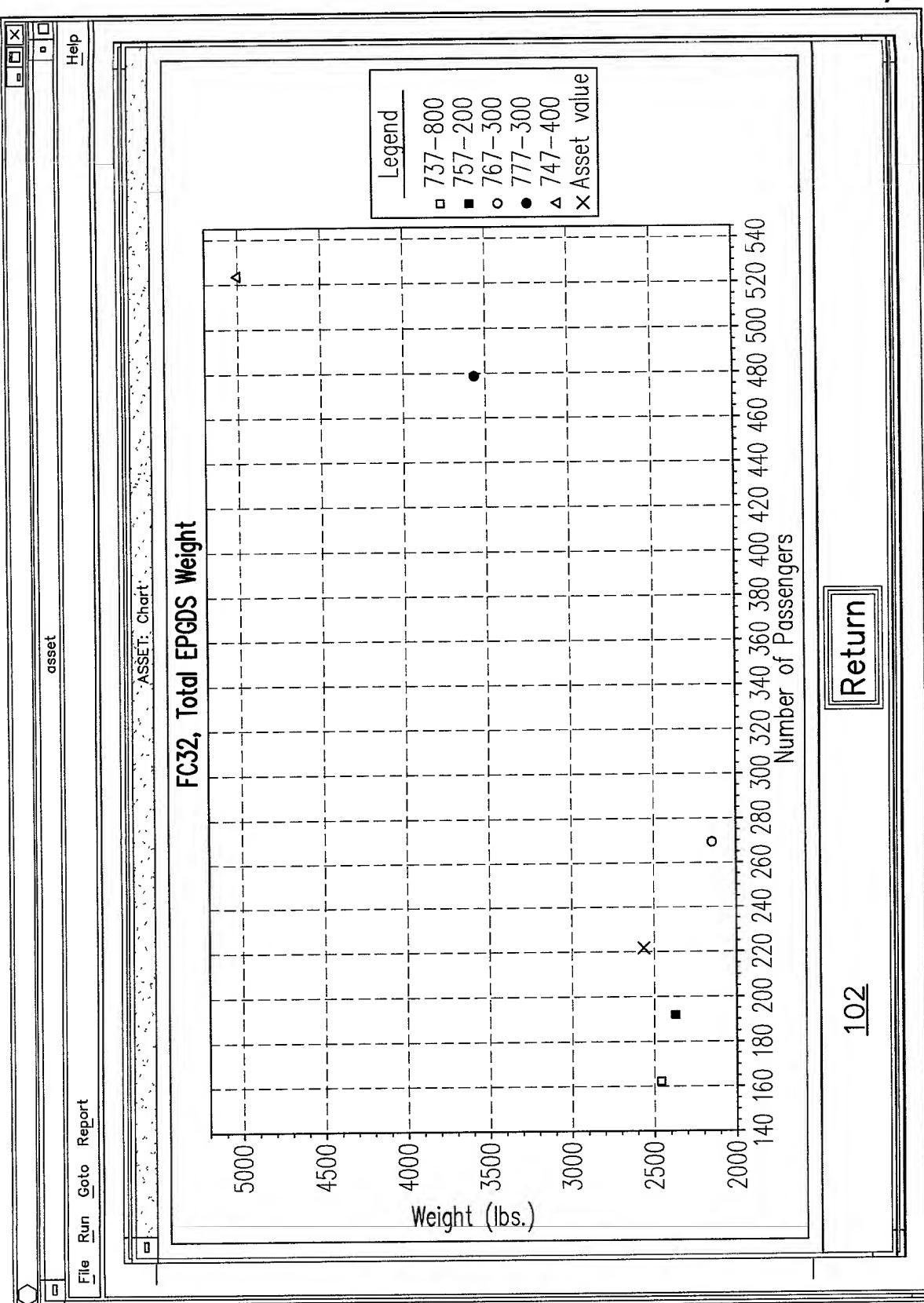


FIG. 77

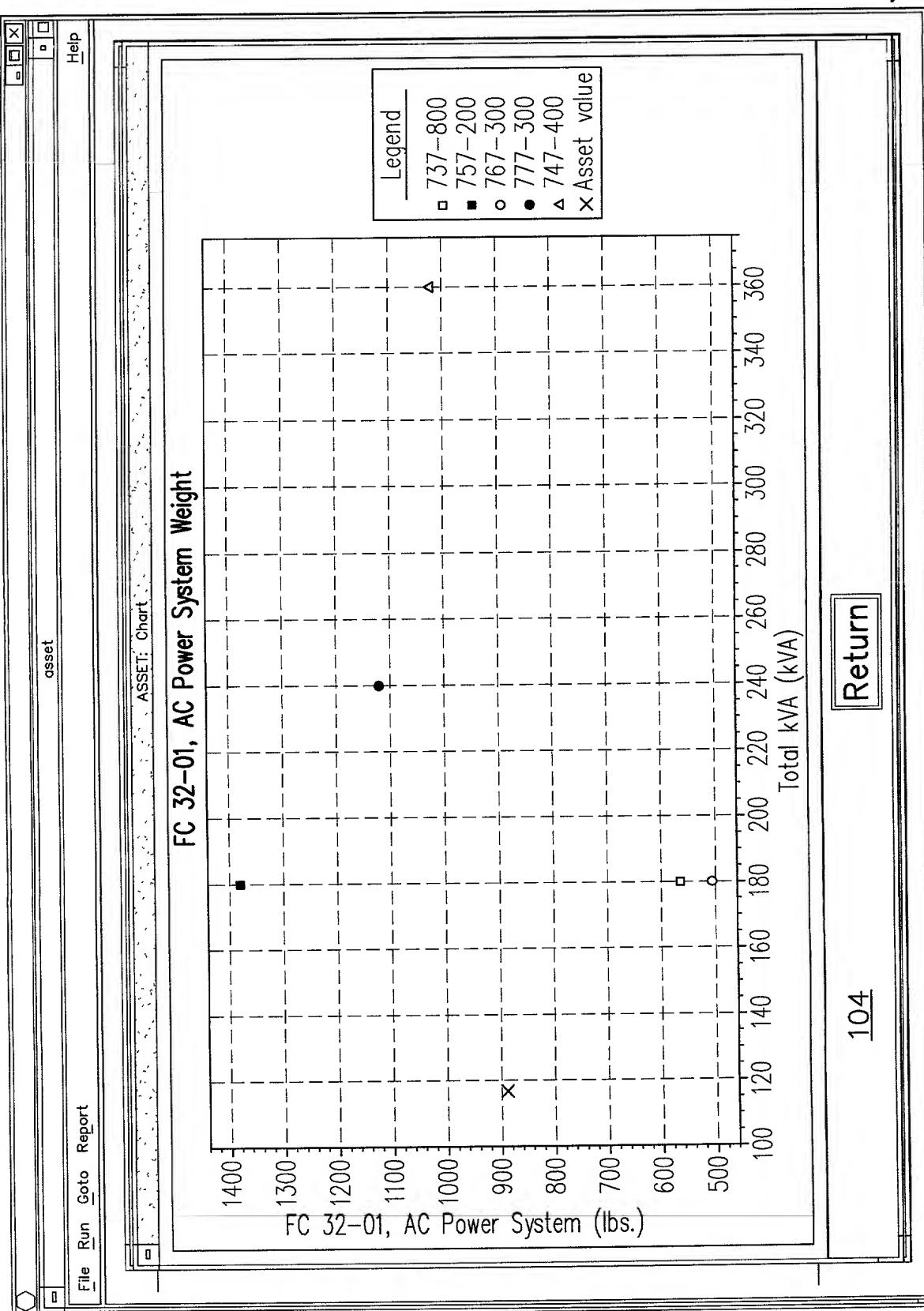


FIG. 78

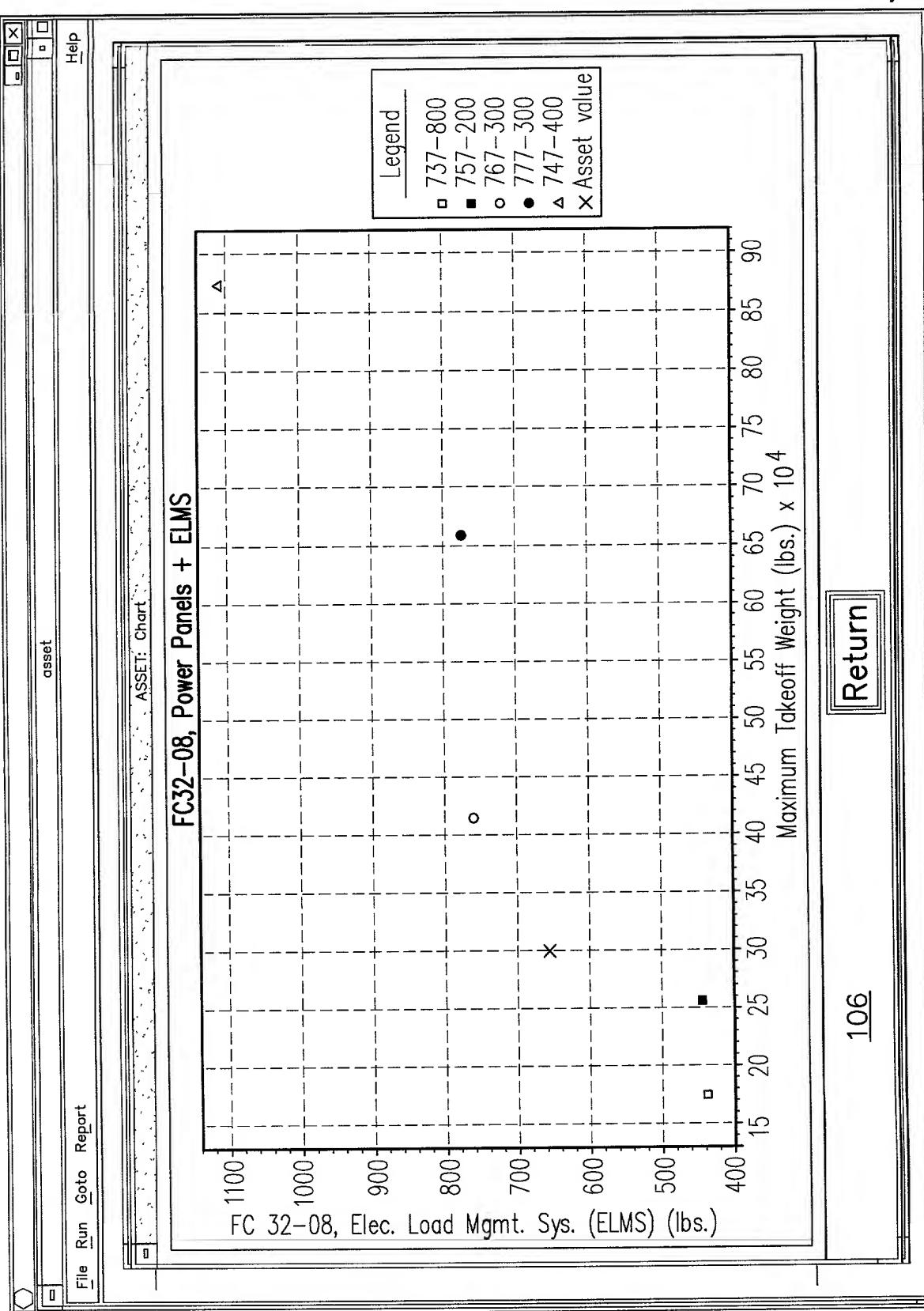
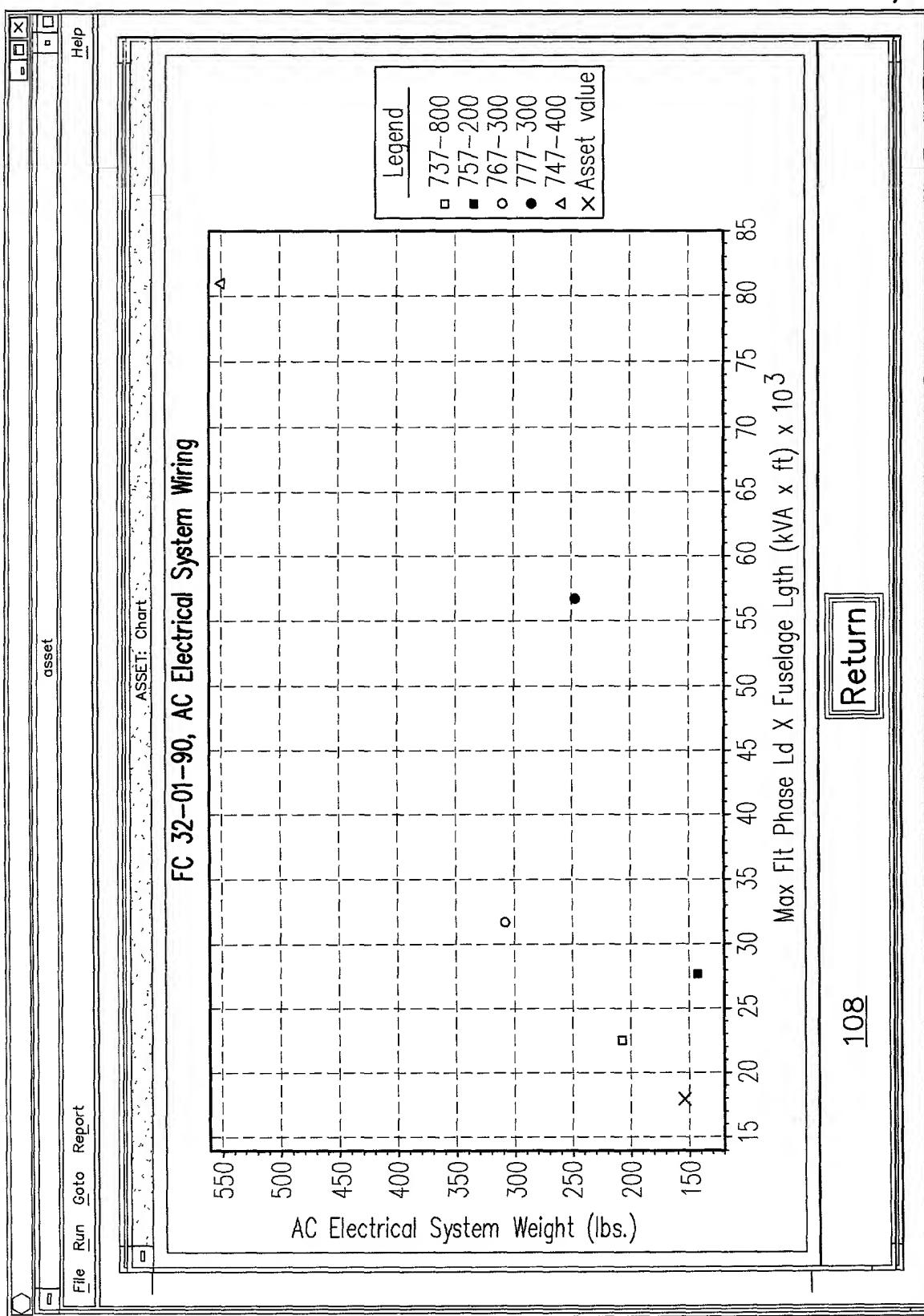


FIG. 79



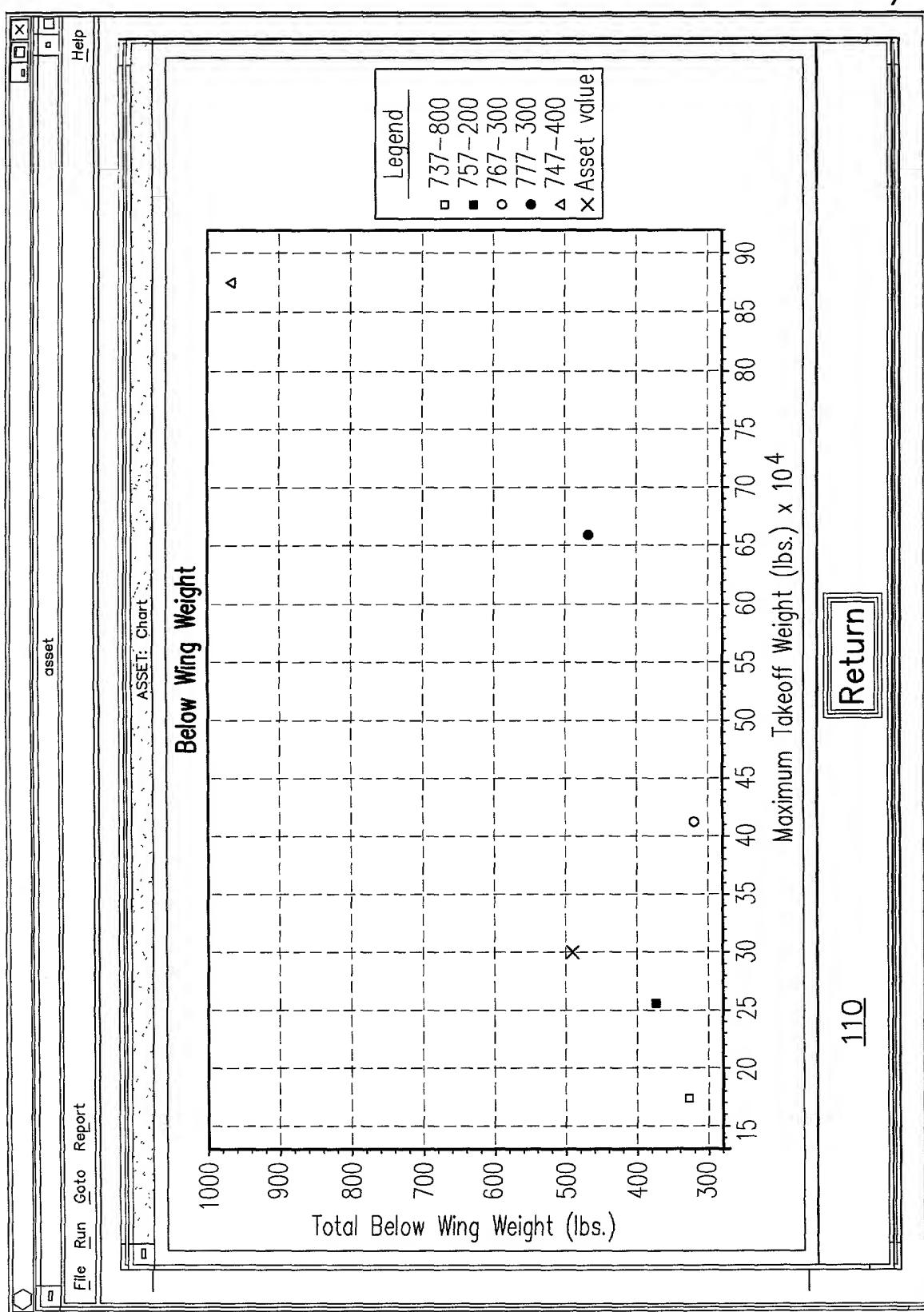


FIG. 81